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Bruhat Bengaluru Mahanagara Palike

CONSULTANCY SERVICES FOR THE PREPARATION OF

DETAILED PROJECT REPORT

Name of Work: "Restoration and Improvements of roads from Doddaballapura main road to Nagarjuna college, Kaveri layout, Chowdappa layout, Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12)"

AARTN ASSOCIATES
The Modern Construction Solution

#1059, MIG-A Sector, Opp Railwheel Factory
Yelahanka New Town, Bangalore-560064
CELL: 8048505503

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GO Sl. No.	Name of Work	Estimate Cost, Rs in Lakhs.
01.	Restoration and Improvements of roads from Doddaballapura main road to Nagarjuna college s in ward no-03 of Yelahnaka Satellite town sub division	300.00
02.	Restoration and Improvements of balance roads, Kaveri layout and surrounding areas in ward no-03 of Yelahnaka Satellite town sub division	250.00
03.	Restoration and Improvements of balance roads of Chowdappa layout, Maruthinagara, Hariraja layout and surrounding areas in ward no-03 of Yelahnaka Satellite town sub division	450.00
	Total Cost of the Project, Lakh Rs.	1000.00

Estimated Cost in Rs. 1000.00

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BRUHAT BENGALURU MAHANAGARA PALIKE

"Consultancy Service for Detailed Project Report, Field Survey, General Report, Basic Drawing, Technical Report, Detailed Drawing, Detailed Cost Estimate for Restoration and Improvements from Doddaballapura Main Road to Nagarjuna college, Kaveri layout, Chowadappa layout Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12)

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bus depots that BMTC maintains are the Kempegowda Bus Station, locally known as "Majestic bus stand", Shantinagar Bus Depot, and Shivajinagar Bus Depot.

CLIENT :-

The client is Bruhat Bengaluru MahanagaraPalike, Bengaluru and is the Authority for the implementation of this project.

CONSULTANT :-

AARTNASSOCIATES, Bengaluru has been entrusted with the work of preparation of detailed project report including the preparation "Consultancy Service for Detailed Project Report, Field Survey, General Report, Basic Drawing, Technical Report, Detailed Drawing, Detailed Cost Estimate for Restoration and Improvements from Doddaballapura Main Road to Nagarjuna college, Kaveri layout, Chowadappa layout Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12)

The Package -12 consists of as detail below:-

GO Sl. No.	Name of Work	Estimate Cost, Rs in Lakhs.
01.	Restoration and Improvements from Doddaballapura Main Road to Nagarjuna college, and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.	300.00
02.	Restoration and Improvements of Kaveri layout, and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.	250.00
03.	Restoration and Improvements of Chowadappa layout Maruthinagara, Hariraja layout and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.	450.00
	Total Cost of the Project, Lakh Rs.	1000.00

1.2 Project Objectives

The following are the main objectives of the present study:

a) The main objective of the study is to propose the best possible options for the improvements with sophisticated facilities and safe geometrics, so as to avoid land acquisition and minimise construction costs.

b) To carry out the engineering surveys, site investigations, and material investigations.

c) Traffic surveys for present traffic and assessment of projected traffic for the design period.

d) Structural and functional evaluation of the pavement.

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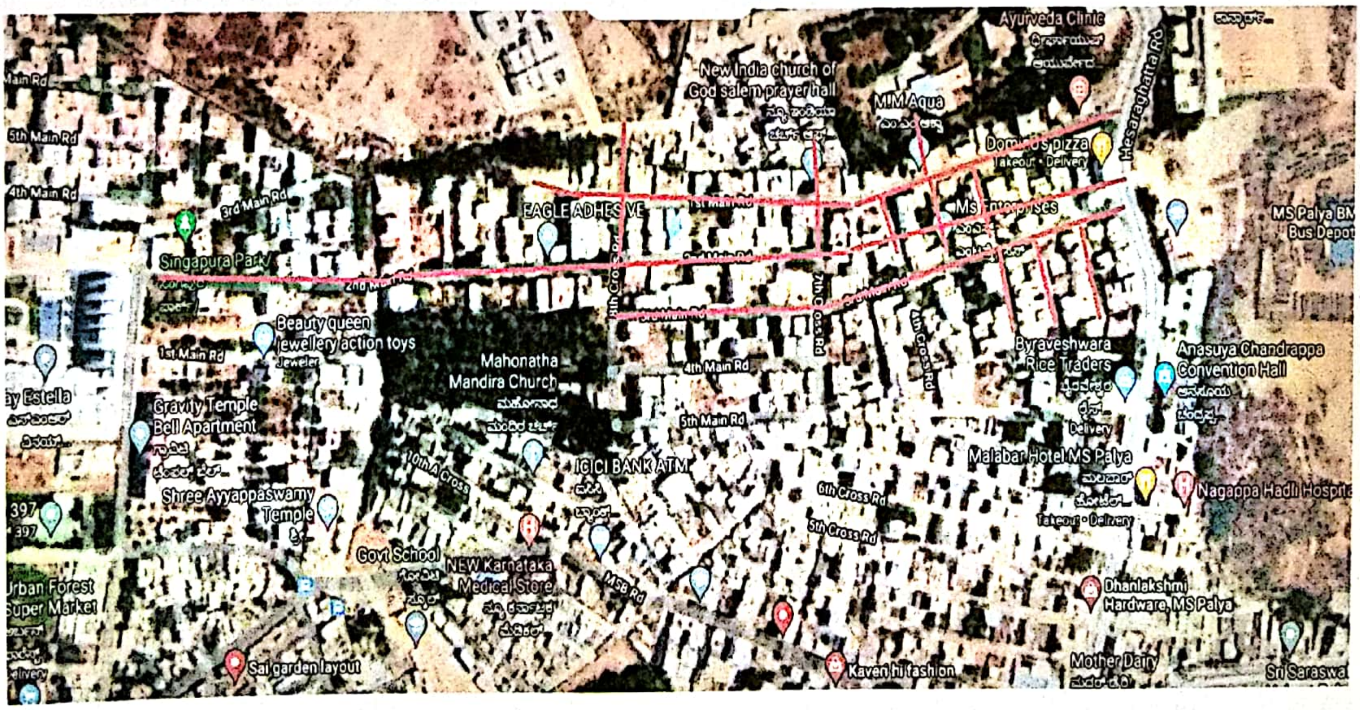
"Consultancy Service for Detailed Project Report, Field Survey, General Report, Basic Drawing, Technical Report, Detailed Drawing, Detailed Cost Estimate for Restoration and Improvements from Doddaballapura Main Road to Nagarjuna college, Kaveri layout, Chowadappa layout Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12) "

A) Restoration and Improvements from Doddaballapura Main Road to Nagarjuna College, and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.



B) Restoration and Improvements of Kaveri layout, and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.

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"Consultancy Service for Detailed Project Report, Field Survey, General Report, Basic Drawing, Technical Report, Detailed Drawing, Detailed Cost Estimate for Restoration and Improvements from Doddaballapura Main Road to Nagarjuna college, Kaveri layout, Chowadappa layout Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12) "

C) Restoration and Improvements of Chowadappa layout Maruthinagara, Hariraja layout and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.

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- Geometric Design
- Pavement Design
- Drainage
- Road Furniture and Appurtenances
- Bridges and CD Structures

3.6.2 Design Standards Related to Geometric Design

Design standards related to road geometric along with the suggested design values/standards and recommended values based on site conditions and data analysis are detailed in Table 3.4

Table 3.4 Geometric Design Standards

Sl. No	Design Parameters	Design Values
1.	Design Speed	Design speed Considered is 40kmph
2.	Geometric Design Standards	
	• Carriageway Width	Two lane carriage way
	• Camber (Bi-directional)	2.5% for paved carriageway.
	• Super Elevation	Limited to 4%
	• Footpath	Minimum width-1.5%
	• Kerb	Barrier/Semi-barrier/Mountable (Barrier type recommended)
	• Extra Widening at Curves	Nil for Radius above 300m
	• Gradient	Maximum Gradient-4.0% (1 in 25) Minimum Gradient for Drainage- 0.5% (desirable minimum) & 0.3% (absolute minimum)

3.6.3 Design Standards Related to Pavement Design

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	• Drain Type	Cast in situ RCC box drain with Precast RCC cover slab RCC box culverts across cross roads.
	• For Existing Drains	Desilting and Rectification of Damaged Portion

3.6.6 Design Standards Related to Road Furniture and Appurtenances

Utility and importance of the road are greatly enhanced by initialling road furniture and appurtenances at appropriate locations along the project road, which ensure improved road safely. Planning and design of road furniture and appurtenances are a per the guidelines stipulated in IRC. Detailing of each of these components has been done so as to integrate the same with the road improvement scheme. The suggested design values/standards are detailed in Table 3.8

Table 3.8 Design Standards Related to Road Furniture and Appurtenances

Sl. No	Design Parameters	Reference Code/Design Values
1	Road Markings	IRC:35-1997 "Code of Practice for Road Markings"
2	Road Signs	IRC:67-2001 "Code of Practice for Road Signs"
3	Road Delineators	IRC:79-1981 "Recommended Practice for Road Delineators"
4	Pedestrian Facilitates	IRC:103-1988 "Guidelines for Pedestrain Facilities"

In addition to the above measures various other integral road components have been planned so as to achieve the maximum and optional use of the carriageway with no/ least interference to traffic flow at the same time ensuring adequate facilities to other road users especially pedestrians. All the encroachments, if any shall be cleared within the ROW.

3.6.7 Design Standards Related to CD Structures

The design standards and loading considered for culverts and bridges are as stipulated in latest IRC codes/ Special publications supplemented by appropriate MOST circulars and/or IS codes. The unsafe and/or deficient bridge and culvert structures (existing) will be rehabilitated or replaced by sound structures.

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Table-4.1 Physical requirements for GSB layer materials

Requirement	Test Standards	Limits
Aggregate impact value	IS:2386 (part-4) or IS:5640	40% maximum
Liquid limit	IS:2720 (Part-5)	25% maximum
Plasticity index	IS:2720 (Part-5)	6% maximum
CBR @ 98% Dry density	IS:2720 (Part-5)	Minimum 30% unless otherwise specified in contract

Grading for Granular Sub Base Material as per MORTH Revision - V

IS Sieve Designation	Percent by Weight Passing the IS Sieve (Greading V)
75.0 mm	100
53.0 mm	80-100
26.50 mm	55-90
9.50 mm	35-65
4.75 mm	26-50
2.36 mm	10-20
0.85 mm	2-10
0.425 mm	0-5

4.4 Wet Mix Macadam Sub-Base/Base

- **Scope-**This work shall consist of laying and compacting clean, crushed, gradedaggregate and granular material, premixed with water. The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the Engineer.
- **Materials-**Coarse aggregates shall be crushed stone. Physical requirements of coarseaggregates for WMM are listed in table-4.2.

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Table-4.2 Physical requirements of coarse aggregates for WMM

Test	Test Method	Requirements
Los Angeles abrasion value Or Aggregate Impact value	IS : 2386 (Part-4) IS : 2386 (Part-4) or IS : 5640	40% (Max.) 30% (Max.)
Combined Flakiness and Elongation indices (Total)	IS : 2386 (Part-1)	35% (Max.)

- **Preparation of mix:** Wet Mix Macadam shall be prepared in an approved mixingplant of suitable capacity having provision for controlled addition of water and forced/positive mixing arrangement like pugmill or pan type mixer of concrete batching plant.
- **Spreading of mix:** Immediately after mixing, the aggregates shall be spreaduniformly and evenly upon the prepared subgrade/sub-base/base in required quantities. The mix may be spread either by a paver finisher or motor grader.
- **Compaction:** After the mix has been laid to the required thickness, grade andcrossfall/camber the same shall be uniformly compacted, to the full depth with suitable roller. If the thickness of single compacted layer does not exceed 100 mm, smooth wheel roller of 80 to 100kN weight may be used. For a compacted single layer upto 200 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100kN or equivalent capacity roller. The speed of the roller shall not exceed 5 km/h. The roller shall then progress gradually towards the center parallel to the centre line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled. If irregularities develop during rolling which exceed 12 mm when tested with a 3m straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and cross fall. In no case should the use of unmixed material be permitted to make up the depressions. Rolling shall be continued till the

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density achieved is at least 98% of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part-8).

Grading Requirements of Aggregates for Wet Mix Macadam is as given in table bellow

IS Sieve Designation	Percent by Weight Passing the IS Sieve
53.00 mm	100
45.00mm	95-100
26.50 mm	-
22.40mm	60-80
11.20mm	40-60
4.75mm	25-40
2.36mm	15-30
600.00 micron	6-22
75.00 micron	0-5

Binder : Selection criteria for viscosity grade bitumen , based on highest and lowest daily mean temperature at a particular site , are given in Table 500-1 of MORTH revision V .

4.5 Prime Coat over Granular Base

- **Scope-**This work shall consist of application of single coat of low viscosity liquid bituminous material to an absorbent granular surface preparatory to any superimposed bituminous treatment or construction.
- **Materials-**The choice of a bituminous primer shall depend upon the porosity characteristics of the surface to be primed as classified in IRC: 16 i.e.
  1. Surfaces of low porosity; such as wet mix macadam and water bound macadam,
  2. Surfaces of medium porosity; such as cement stabilized soil base,
  3. Surfaces of high porosity; such as a gravel base.
- **Construction**

Equipment: The primer distributor shall be pneumatic tyred self-propelled pressure distributor equipped for spraying the material uniformly at the specified rates and

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- **Materials**

Bitumen: The bitumen shall be paving bitumen of Penetration Grade S-65 or A-65 (60/70) as per IS: 73-Indian Standard Specifications for "Paving Bitumen".

Coarse aggregates: The coarse aggregates shall consist of crushed stone, crushed gravel/shingle or other stones. They shall be clean, strong, durable, of fairly cubical shape and free from disintegrated pieces, organic or other deleterious matter and adherent coating. The aggregates shall preferably be hydrophobic and of low porosity. Its physical requirements are as shown in Table-4.4.

Table-4.4 Physical Requirements of Aggregates for Dense Bituminous Macadam

Sl.No	Test	Test Method	Requirement
1	Los Angles Abrasion	IS:2386(Part-4)	35% Maximum
2	Aggregate Impact value	IS:2386(Part-4)	27% Maximum
3	Flakiness and Elongation Indices (Total)	IS:2386(Part-1)	35% Maximum
4	Coating and Stripping of Bitumen Aggregate Mixtures	AASHTO T 182	Minimum retained coating 95%
5	Soundness (i) Loss with Sodium Sulphate-5 cycles (ii) Loss of Magnesium Sulphate-5 cycles	IS:2386(Part-5)	12% Maximum 18% Maximum
6	Water absorption	IS:2386(Part-3)	2% Maximum

- **Marshall Criteria Dense Bituminous Macadam Mix**
  - Marshall Stability (ASTM Designation-D-1559) determined on Marshall Specimens compacted by 75 compaction blows on each end: 9kN minimum.
  - Marshall flow (mm): 2-4
  - % Air voids: 3-5

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- Minimum voids in mineral aggregates (VMA): 11% -12 %
- % Voids in mineral aggregates filled by bitumen (VFB): 65-75

Binder content % by weight of total mix: Not less than 4.0% , Grading Require for Mineral Filler as per MORTH V Revision as Table below

IS Sieve (mm)	Cumulative Percent Passing by Weight of Total Aggregate
0.6	100
0.3	95–100
0.75	85–100

The Composition of Dense Graded Bituminous Macadam as follows in Table below –

Grading	1	2
Nominal Aggregate Size	37.5 mm	26.5mm
Layer Thickness	75-100 mm	50-75 mm
IS Sieve(mm)	Cumulative percentage of Weight by Total Aggregate Passing	
45	100	
37.5	95-100	100
26.5	63-93	90-100
19	-	71-95
13.2	55-75	56-80
9.5	-	-
4.75	38-54	38-54
2.36	28-42	28-42
1.18	-	-
0.6	-	-
0.3	7-21	7-21
0.15	-	-
0.075	2-8	2-8
Bitumen content % by mass of total mix	Min 4.0"	Min 4.5"

- **Construction**
  - Preparation and Transportation of Mix.
  - The Individual bins of hot mix plant shall be calibrated for the particular size of material.

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given inTable 500-8 from MORTH 5th revision except that the maximum value for the water absorption should be 1%.

TABLE-4.5 PHYSICAL REQUIREMENTS OF AGGREGATES FOR BITUMINOUS CONCRETE

Sl.No	Test	Test Method	Requirement
1	Los Angles Abrasion	IS:2386(Part-4)	30% Maximum
2	Aggregate Impact value	IS:2386(Part-4)	24% Maximum
3	Flakiness and Elongation Indices (Total)	IS:2386(Part-1)	35% Maximum
4	Coating and Stripping of Bitumen Aggregate Mixtures	AASHTO T 182	Minimum retained coating 95%
5	Soundness (i) Loss with Sodium Sulphate-5 cycles (ii) Loss of Magnesium Sulphate-5 cycles	IS:2386(Part-5)	12% Maximum 18% Maximum
6	Water absorption	IS:2386(Part-3)	2% Maximum

- **Marshall Criteria Bituminous Concrete Mix**
  - Marshall Stability (ASTM Designation D-1559) determined on MarshallSpecimens compacted by 75 compaction blows on each end: 9kN minimum.
  - Marshall flow (mm): 2-4
  - % Air voids: 3-5
  - Minimum voids in mineral aggregates (VMA): 10 % - 12 %
  - % Voids in mineral aggregates filled by bitumen (VFB): 65-75
  - Binder content % by weight of total mix: Not less than 5.4%

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- Water Sensitivity (ASTM D1075) Loss of stability on immersion in water at 60Cstrength: Min 80 % retained

Composition of Bituminous Concrete Pavement Layers as given in Table below :-

Grading	1	2
Nominal Aggregate Size	19mm	**13.2mm**
Layer Thickness	50mm	**30-40mm**
IS Sieve(mm)	Cumulative percentage of Weight by Total Aggregate Passing	
45		
37.5		
26.5	100	
19	90-100	100
13.2	59-79	**90-100**
9.5	52-72	**70-88**
4.75	35-55	**53-71**
2.36	28-44	**42-58**
1.18	20-34	**34-48**
0.6	15-27	**26-38**
0.3	10-20	**18-28**
0.15	5-13	**12-20**
0.075	2-8	**4-10**
Bitumen content % by mass of total mix	MIN 5.2"	**Min 5.4"**

- **Construction**
  - Preparation and Transportation of Mix.
  - The Individual bins of hot mix plant shall be calibrated for the particular size ofmaterial.
  - Material shall be fed to the mixing plant bins provided for individual sizes ofaggregates to meet the required gradation.

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Aggregate Gradation for Pavement Quality Concrete as given in Table below :-

Sieve Designation	Percentage by Weight Passing the Sieve
31.5mm	100
26.5mm	85-95
19.0mm	68-88
9.5mm	45-65
4.75mm	30-55
600 micron	8-30
150 micron	5-15
75 micron	0-5

4.11 Construction Methodology for Concrete drain

➢ Design Standards Related to Road Drainage

Drainage of water from pavement surface is of paramount importance as far as preserving the road assets created by investing huge funds in addition to maintaining the structural soundness and functional efficiency of the road. Design standards related to road drainage are essentially based on the guidelines given in IRC: SP:42-1994 "Guidelines of Road Drainage" and in IRC: SP:50-1999 "Guidelines on Urban Drainage". The suggested design values/standards are detailed in Table 4.6below .

Table 4.6 Design Standards Related to Road Drainage

Sl. No	Design Parameters	Design Values
1	• Camber	1.7-2.5% (bi-directional) for carriageway(camber of 3 % is adopted).
	• Longitudinal Gradient	Minimum 0.3%-0.5% for satisfactory drainage
	• Drain Type	Cast in situ RCC box drain with Precast RCC cover slab RCC box culverts across cross roads.
	• For Existing Drains	Desilting and Rectification of Damaged Portion

4.11.1 Excavation for Drains

The work shall consist of excavation, removal and satisfactory disposal of all materials necessary for the construction side drains and culverts in accordance with

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CHAPTER 5
TRAFFIC SAFETY AND CONTROL DURING CONSTRUCTION

5.1 General

The arrangement for traffic during construction shall be in accordance with the IRC: SP-55-2001-"Guidelines on safety in road construction zones" and Clause 112 of MOST specifications.

The traffic arrangement during construction shall be so as to ensures that –

- Road users are accommodated through and around the construction zones safely with minimum of delays;
- Traffic control and the construction activities are co-ordinate to provide for safe and efficient flow of traffic together with efficient, safe and rapid progress of the construction activity.
- Where construction activities are taking place at multiple sites along the same or on parallel routes, construction activity and the movement of road users is co-ordinate to ensure that the total delay along the route or on signed alternative routes is within acceptable limits.
- Driver behavior is effectively influenced so that the speeds are reduced to the desired levels on the approaches to and within the construction zones; and
- In the urban environment, works requiring partial road closures on alternative routes should be phased, so that they are not undertaken at the same time.
- For widening of existing two-lane to four lanes, the additional two-lanes shall be constructed first and the traffic diverted to it and only thereafter the required treatment to the existing carriageway shall be carried out.
- The contractor shall at all times carry out work on the highway in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. For all works involving improvements to the existing highway. The Contractor shall, in accordance with the directives of the Engineer, provide and

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maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion

- constructed close to the highway. The Contractor shall take prior approval of the Engineer regarding traffic.

5.2 Traffic safety and control

The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement.

The barricades erected on either side of the carriageway / portion of the carriageway closed to traffic, shall be of strong design to resist violation, and painted with alternate black and white stripes. Red lanterns of warning lights of similar type shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise.

At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriageway) the channel for traffic shall be clearly marked with the aid of pavement markings, painted drums or similar devices as per the directions of the Engineer. At night, the passage shall be delineated with lanterns or other suitable light source.

5.3 Maintenance of Diversions and Traffic Control Devices

Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversions shall be maintained in a satisfactory condition till such time they are required as directed by the Engineer. The temporary diversion road shall be kept free of dust by frequent applications of water, if necessary

5.4 Safety in road construction zones

The construction zone creates an environment where the road user is faced with a series of unusual hazards in the form of unfamiliar routes, substandard horizontal and vertical alignment, adverse cambers, construction equipment etc. The road user also has to watch for traffic control devices apart from performing normal driving functions of vehicle

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CHAPTER 6

TECHNICAL REPORT

6.1 General

The cost estimate has been prepared separately for the road and given in the other volume.

6.2 Rate Analysis

Unit rates have been adopted for the items of the project based on the Karnataka state PWD schedule of rates i.e. PWDSR 2018-19 for Bangalore District.

6.3 Cost Components for Quantification

The construction items covered in cost estimates include different heads such as:

- Improvements of drains .
- Improvements of roads(Flexible Pavements)
- Improvements of roads(Rigid Pavements)
- Road Furniture and Other Works

6.4 Total Cost for Project Road

The various cost components like cost of roadwork, CD works and provisions for other items such as tender premium, miscellaneous provisions, QC and DPR charges, Cost of Plastic used for BC in wearing course and construction supervision have been included in the project costing for road sections. The abstract and cost estimate for the project roads is summarized in Volume II.

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The various Codes and IRC, BS, AASHTO Adopted for Design as standards along with MORTH Vth Revision are as follows:-

Field Dry Density (FDD) using Sand Replacement Method	IS: 2720 (Part 28)
Field Dry Density (FDD) using Core Cutter Method	IS: 2720 (Part 29)
Moisture Content Determination	IS: 2720 (Part 2) (Section I)
Atterberg Limits	IS: 2720 (Part 5)
Sieve Analysis - Natural soils - Rock aggregate	 IS: 2720 (Part 4) IS: 2386 (Part 1)
Compaction Test (Heavy Compaction)	IS: 2720 (Part 8)
CBR (Soaked and unsoaked at three energy levels for sub-grade)	IS: 2720 (Part 16)
Free Swell Index	IS: 2720 (Part 40)
Aggregate Impact Value (AIV)	IS: 2386 (Part 4)
Coating and Stripping of Bitumen Aggregate Mixes	IS: 6241
Soundness of Aggregates	IS: 2386 (Part 5)
Flakiness and Elongation Indices	IS: 2386 (Part 1)
Water Absorption and Specific Gravity of Aggregates	IS: 2386 (Part 3)
10 % Fines Value for Aggregates	BS: 812 (Part 111)

Soil classification has been done according to the Indian Soil Classification (ISC) System, as detailed in IS: 1498.

SL NO.	Design Parameters	Reference Code
1	Geometric Design Standards • Carriageway width • Shoulder • Footpath • Median • Camber • Super Elevation • Horizontal Alignment • Vertical Alignment	As per IRC:38-1988 IRC:86-1983 & IRC: SP:38-1993
2	Road Furniture • Road Delineators • Road Markings • Road Signs	As per IRC:79-1981 As per IRC:35-1997 As per IRC:67-2001
3	Road Capacity	As per IRC:106-1990
4	Pavement Design	As per IRC:37-2012& IRC: SP:62-2014 , IRC 58-2015
5	Overlay Design	As per IRC:81-1997
6	Road Drainage	As per IRC: SP:42-1994& As per IRC: SP:50-1999
7	Culverts	As per relevant IRC codes and

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		MORT&H
8	Road Markings	IRC:35-1997 "Code of Practice for Road Markings"
9	Road Signs	IRC:67-2001 "Code of Practice for Road Signs"
10	Road Delineators	IRC:79-1981 "Recommended Practice for Road Delineators"
11	Pedestrian Facilitates	IRC:103-1988 "Guidelines for Pedestrain Facilities"
12	Standard Specifications and Code of Practice for Prime and Tack Coat	IRC:16-2008
`13	Code of Practice for Road Markings (Second Revision	IRC:35-2015
14	Recommended Practice for Construction of Earth Embankments and Sub-Grade for Road Works	IRC:36-2010
15	Guidelines for Cement Concrete Mix Design for Pavements	IRC:44-2017
16	Guidelines for the Design of Plain Jointed Rigid Pavements	IRC:58-2015
17	Standard Specifications and Code of Practice for Road Bridges, Section VII- Foundations and Substructures	IRC:78-2014
18	Recommended Practice for Road Delineators	IRC:79-1981
19	Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique	IRC:81-1997
20	Code of Practice for Curing of Cement Concrete Pavements	IRC:84-1983
21	Recommended Practice for Accelerated Strength Testing & Evaluation of Concrete	IRC:85-2015
22	Guidelines for Capacity of Urban Roads in Plain Areas	IRC:106-1990
23	Guidelines for Wet Mix Macadam	IRC:109-2015
24	Specifications for Dense Graded Bituminous Mixes	IRC:111-2009
25	Guidelines for the use of Waste Plastic in Hot Bituminous Mixes (Dry Process) in Wearing Courses	IRC:SP-98-2013
26	Road Drainage	IRC :SP-50-1999
27	Overlay Design	IRC: 81-1997

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IS Standards		
1	Aggregate impact	IS:2386 (part-4) or IS:5640
2	value	IS:2720 (Part-5)
3	Liquid limit	IS:2720 (Part-5)
4	Plasticity index	IS:2720 (Part-5)
5	CBR @ 98% density	IS : 2386 (Part-4)
6	Los Angeles abrasion value Or Aggregate	IS : 2386 (Part-4)
7	Impact value	IS : 2386 (Part-4) or IS:5640
8	Combined Flakiness and Elongation(Total)	IS : 2386 (Part-1)
9	Los Angles Abrasion	IS:2386(Part-4)
10	Aggregate Impact value	IS:2386(Part-4)
11	Flakiness and ElongationIndices (Total)	IS:2386(Part-1)
12	(i) Loss with Sodium Sulphate-5cycles	
13	(ii) Loss of Magnesium Sulphate-5 cycles	IS:2386(Part-5)
14	Water absorption	IS:2386(Part-3)
15	Compaction of GSB/WMM layer	IS:2720(Part-08)
AASHTO		
1	Coating and Stripping of Bitumen aggregate MixturesSoundness	AASHTO T 182
BS		
1	Psychical requirements for GSB	BS:812(Part -3)

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RATE ANALYSIS

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BRUHAT BENGALURU MAHANAGARA PALIKE

Executive Engineer Yelahanka Sub Division

NAME OF WORK:- Restoration and Improvements of roads from Doddaballapura main road to Nagarjuna collage, Kaveri layout, Chowdappa layout, Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12)

Rate Analysis

Sl. No.	Description	Unit	Item no.	Page No	Basic Rate	Lead	Area Weightage (3%)	Final Rate
	1	2	3	4	5	6	7	8
1	KSRRB M300-14. Excavation for roadwork in soil with hydraulic excavator of 0.9 cum bucket capacity including cutting and loading to tippers, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross sections, and transporting to the embamkemnt location to a lead of 1.00 km and complete as per specifications MORTH Specification No.301 (I No-19.14,P No-143)	cum	Item No.19.1	page no .143	41.00	20.48	2.46	63.94
2	KSRRB 300-58. Compaction of original ground by mechanical means including filling in depression occuring during rolling including cost of all labour, HOM complete as per specifications.(I No-19.64,P No-147)	Sqm	I No-19.64	,P No-147	6.00	0.00	0.36	6.36
3	Construction of granular sub-base Grading-V as Sub-base and drainage layer by providing coarse graded crushed stone aggregates of granite/ trap/basalt material, mixing in a mechanical mix plant at OMC, Carriage of mixed material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the 98 % proctor density, complete as per specifications Clause 401 of MORTH V Revision.(I No-20.5,P No-153)	cum	I No-20.5	P No-153	1882.00	0.00	112.92	1994.92

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4	KSRRB M600-1.Providing and Constructing dry lean cement concrete mix CC 1:5:10 base with OPC 25mm and down size graded granite metal coarse aggregate at 0.86cum and 0.86cum and fine aggregate @0.58cum over a prepared sub-base,coarse and fine aggregate conforming to IS: 383-2016,aggregate cement ratio not to exceed 15:1.Aggregate gradation after blending to be as per Table 600-1,optimum moisture content to be determind during trial length construction,concrete strength not be determinde during trial length costruction, concrete strength not to be less than 10Mpa at 7 days,mixed in a batching plant,transported to site,laid with a paver,compacting with 8-10 tonnes vibratory roller, finishing and curing complete as per specications. Clause 601 of MORTH V Revision and IS 456 Table-5 , with OPC at 150 kg/cum and coarse aggregate 0.86 cum,fine aggregate 0.58 cum using concrete Batch mix Plant at 75 cum/hr capacity with fixed form paver 22.1.2,Pg No.-174 ..	cum	Item No 22.1.2	Page No174	3665.00	166.41	229.88	4061.29
5	Constructing un-reinforced,plain cement concrete for pavements using Grade concrete M30 over a prepared base with OPC coarse aggregate at 0.69 cum,fine aggregates at 0.46 cum.coarse and fine aggregate conforming to IS:383-2016,with Superplastizer at 3 lts conforming to IS 9103-2008.mixed in a concrete mixer of not less than 0.6 cum capacity and appropriate weigh batcher as per approved mix design,laid in approved fixed side form work (sreel channel,layning and fixing of 125 micron thick polythene fim, wedges, steel plates including levelling the form work as per drawing). & Speration the concrete with shovels, rackers compacted using needle, screed and plate vibrator and finished with floaters in a construction and longitudinal joints,including groove cutting charges,joint filler,separation membrane of impermiable plastic sheet of 125 micron,sealant primer, joint sealant, admixtures as approved, curring compound, finishing to lines and grades, textured with texturing machine, and curing including cost of all materials,labour,hire charges of machineries , all lead & lift charges etc., complete as per specifications.with OPC AT 360 kg/cum and coarse aggregate 0.69,fineaggregate 0.46cum. Item No.-22.6.3,Page No.-176	Sqm	Item No 22.6.3	Page No176	4916.00	399.38	318.92	5634.31

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6	KSRB 4-1.6 Providing and laying in postion **Plain cement concrete of Mix 1:2:4 with OPC @ 240kgs**, with 20mm and down size graded granite metal coarse aggregates @ 0.878 cum and fine aggregates @ 0.53cum, machine mixed, concrete laid in layers not exceeding 15cms, thick, well compacted, in **foundation, plinth and cills**, including cost of all materials, labour, HOM curing complete as per specifications. Specification No. KBS 4.1, 4.2 Page No-13, Item No-4.6.(PWD BCSR 2018-19)	Sqm	Item No - 4.6	Page No-13,	5422.00	266.26	341.30	6029.55
7	KSRB 4-1.3 . Providing and laying in position **plain cement concrete ofg Mix 1:4:8 with** opc @150kgs, with 40mm and down size graded granite metal coarse aggregates@0.85 cum and fine aggregates @0.57 cum machine mixed , machine mixed, concrete laid in layers not exceeding 15cms. thick, well compacted, in foundation, including cost of all materials, labour, HOM curing complete as per Specifications. Specifications No. KBS 4.1 , 4.2 .Pg No 30	cum	Item No.4.2	Pg.No 30	5102.00	199.69	318.10	5619.79
8	KSRRB 300 - Excavation for road, drains and similar works KSRRB 300-1. Earthwork excavation by manual means in ordinary soil involving an average horizontal throw upto 2 meters and an average lift upto 0.5 m. excavated surface leveled and sides neatly dressed, the disposed earth to be leveled neatly after breaking of clods complete as per specifications. MORTH / Chapter 3 (P.No-143, I.No-19.1)	Sqm	I.No-19.1)	P.No-143	130.00	77.48	7.80	215.28
9	Providing and laying plain/reinforced cement concrete for side drains using M20 nominal mix concrete with OPC at 300 kgs. with 20mm and down size granite metal coarse aggregates at 0.69 cum and fine aggregates at 0.43 cum machine mixed, well compacted for walls and bottom including centering, shuttering, cost of materials, HOM of machinery, curing etc., complete excluding cost of steel as per MORTH specification No. 1500, 1700, 2200 including cost of materials, labour, HOM complete as per specifications. Wall and Bottom Thickness 15 cm , Item No.37.59.2. Page No 271 -	Cum	Item No.37.59.2	Page No.271.	6670.00	332.82	420.17	7422.99

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10	KSRRB M 2200-6 Providing T.M.T steel reinforcement for R.C.C work including straightening, cutting, bending, hooking, placing in position, lapping and or welding wherever required, tying with binding wire and anchoring to the adjoining members wherever necessary complete as per design (laps, hooks and wastage shall not be measured and paid) cost of materials, labour, HOM of machinery complete as per specifications. Specification No. MORTH Specification No 1600 & 2200 TMT Bars Fe 500 Page No 229 Item No 28.8.2 SR 2018-19	Tn	Item No. 28.8.2	Page No.229.	70966.00	0.00	4257.96	80146.60
11	Providing and Fixing pre cast covering Slab of 100mm thick made out of CC jelly 20mm and down size with steel reinforecement , inclunding form work, lift charges, curing including cost of all materials ,Labour,Hire charges of machineries,loading onloading,lead and lift,Transportation etc,complete. as per Engineer in-charge.(Date rate)	Sqm	Approved Data Rate					1922.00
12	Providing and fixing RCC precast cover slab of 230mm thick for drain in cement concrete 1:1.5:3 using graded granite jelly 20mm and down size with steel reinforcement, including form work, lift charges, curing and concrete finished surfaces on both sides etc, complete and as per drawing and the directions of Engineer in-charge. (Data Rate)	Sqm	Approved Data Rate					4486.00
13	Providing and fixing pre cast solid cement concrete kerb stones made out of C.C 1:2:4 with top and bottom width 114 and 165 mm respectively , 400mm high and 450mm in length finished with CM 1:3 plastering and finishing cutting, including form work, curing, including cost of all materials , labour,hire charges of machinery, loading, unloading, lead and lift, transportation ect., complete.I.No.-5.30,P.No-27 of PWD BCSR 2018-19 .	No's	Item No. 5.30	Page No.27	408.00	0.00	24.48	432.48
14	KSRRB 800-1. Painting two coats after filling the surface with synthetic enamel paint in approved shades on new plastered concrete surfaces, with materials, labour complete as per specifications. MORTH Chapter 8 ,Specification No.KSRRB M800 -6.P.No.180,I.No-24.1 of PW,P & IWTD SR 2018-19 ,	Sqm	Item No. 24.1	Page No.180.	80.00	0.00	4.80	84.80

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15	KSRRB M400-17 Providing, laying spreading and compacting crushed stone aggregates of granite / trap / basalt to wet mix macadam specifications including pre mixing the material with water at OMC in mechanical mix plant carriage of mixed materials by tipper to site, laying in uniform layers with paver in sub-base/base course on well prepared surface and compacting with vibratory roller to achieve the desired density complete as per specifications (P No -155.I No -20.18)	Cum	Item No. 20.18	Page No.155	1888.00	0.00	113.28	2001.28
16	KSRRB M500-6 Providing and applying primer coat with S.S. bitumen emulsion on prepared surface of granular base such as WMM including cleaning of road surface and sparying primer at the rte of 0.60 kg /sqm using mechanical means complete as per specifications Clause 502 of MoRTH V th Revision (pg No 158 I No-21.6), Issue Rate	Sqm	Item No. 21.6	Page No.158	32.00	0.00	1.92	33.92
17	KSRRB 500-7 Providing and applying tack coat using 80/100 grade bitumen (VG10) on the prepared black topped surfaces at 2.5 kg per 10sqm, heating bitumen in boiler fitted with spray set (excluding cleaning of road surface) including cost of materials , labour, HOM complete as per specification P No -158 I No-21.7,Issue Rate	Sqm	Item No. 21.7	Page No.158	12.00	0.00	0.72	12.72
18	KSRRB M500-17 Providing and laying Dense Graded Bituminous Macadam using crushed aggregates of specified grading, premixed with VG30 grade bituminous binder and, transporting the hot mix to work site, laying to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction in all respects complete as per specifications clause 505 of MORTH V revisionusing 40/60 TPH capacity H.M.P. with mechanical paver Gr-II (50mm to 75mm) with 4.5% VG-30 bitumen with all lead and lift and as per the direction of Engineer in-charge I No -21.17.6,Pg No.- 160 ,Data Rate	cum	Item No. 21.17.6	Page No.160	6226.00	0.00	373.56	7292.80

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19	Providing and laying Bituminous concrete , using crushed aggregates of specified grading, premixed with bituminous binder and filler, transporting the hot mix to work site. laying with a paver finisher to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction in all respects complete as per specifications. Clause 507 of MORTH V revision - using 40-60 TPH capacity HMP with mechanical paver grading II (30-40mm) with 5.4% of VG-30 bitumen .Page no-162 It. No - 21.22.6	cum	Item No. 21.22.6	Page No.162	7972.00	0.00	478.32	8450.32
20	KSRRB M800-13. Road Marking with Hot Applied 'Thermoplastic Compound with Reflectrising Glass Beads on Bituminous Surface / Concrete Surface :- Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads at 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35. The finished surface to be level, uniform and free from streaks and holes complete as per specifications .MoRTH Specifications No.803(Pg.No-182,I.No.24.15,	Sqm	Item No. 24.15,	Page No.182	429.00	0.00	25.74	454.74

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21	KSRRB M800-35. Supply and Installtion of Moulded Shank Raised Pavement Markers made of polycarbonate and ABS(Acrylonitrile Butadiene Styrene) moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face and shall support a load of 16000 kg tested in accordance to Specifications of Category A of MORTH Circular No RW/ NH/33023/10-97 - DO III Dt 11.06. 1997. The height, width and length shall not exceed 50 mm, 100 mm and 102 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base shall be 35 degree. The strength of detachment of the integrated cylindrical shanks, (of diameter not less than 19 mm and height not less than 30 mm) from the body is to be a minimum value of 500 Kg. Fixing will be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based adhesive as per manufacturer's recommendation and complete as directed by the engineer (Page No.187. Item No.24.41), SOR 2018-19	No	Item No. 24.41,	Page No.187	337.00	0.00	20.22	357.22

CERTIFICATE:

1 The work spot has been inspected by me and the work is found to be necessary.
2 The estimate is prepared as per PW, P&IWTD S.R Bangalore circle for the year 2018-2019.
3 The Provisions made in the estimate are quite necessary and adequate.
4 The area comes with in the BBMP limits.

Assistant Engineer
Ward No-03
BBMP

Assistant Executive Engineer
Yelahanka New Town Sub Division
BBMP

Executive Engineer
Yelahanka Division
BBMP

AARTN ASSOCIATES ★ BANGALORE ★ DATE

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ABSTRACT

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BRUHAT BENGALURU MAHANAGARA PALIKE

Executive Engineer Yelahanka Sub Division

NAME OF WORK:- Restoration and Improvements of roads from Doddaballapura main road to Nagarjuna collage, Kaveri layout, Chowdappa layout, Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12)

Abstract Cost Estimation

Sl. No.	Description	Unit	Total Qty.	Rate	Amount
	1	2	3	4	5
1	KSRRB M300-14 Excavation for roadwork in all types of soil by mechanical means including cutting and loading to tippers, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross sections, and transportation with a lead of 1.00 km and complete as per specifications MORTH Specificatio MORTH Specification No.301Loading and unloading with 10km lead= (I No-19.14,P No-143)	cum	5008.80	63.94	320262.67
2	KSRRB 300-58 Compaction of original ground by mechanical means including filling in depression occuring during rolling including cost of all labour, HOM complete as per specifications (I No-19.64,P No-147)	Sqm	16696.00	6.36	106186.56
3	Construction of granular sub-base Grading-V as Sub-base and drainage layer by providing coarse graded crushed stone aggregates of granite/ trap/basalt material, mixing in a mechanical mix plant at OMC, Carriage of mixed material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the 98 % proctor density, complete as per specifications Clause 401 of MORTH V Revision (I No-20.5,P No-153)	cum	2504.40	1994.92	4996077.65

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total construction cost	87480421.67
12 % GST	10497650.60
Sub total	97978072.27
DPR AND PMC 2%	2000000.00
Miscellaneous & Rounding off	21927.73
Total Amount	100000000.00

CERTIFICATE:

1 The work spot has been inspected by me and the work is found to be necessary.
2 The estimate is prepared as per PW, P&IWTD S.R Bangalore circle for the year 2018-2019.
3 The Provisions made in the estimate are quite necessary and adequate.
4 The area comes with in the BBMP limits.

Assistant Engineer
Ward No-03
BBMP

Assistant Executive Engineer
Yelahanka New Town Sub Division
BBMP

Executive Engineer
Yelahanka Sub Division
BBMP

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BANGALORE

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DRAFT TENDER SCHEDULE

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BRUHAT BENGALURU MAHANAGARA PALIKE

Executive Engineer Yelahanka Sub Division

NAME OF WORK:- Restoration and Improvements of roads from Doddaballapura main road to Nagarjuna collage, Kaveri layout, Chowdappa layout, Maruthinagara, Hariraja layout and surrounding areas in ward no -03 of Yelahanka New town Sub division (PACKAGE NO-12)

Draft Tender Schedule

Item No.	Description	Unit	Quantity	Rate, Rs	
				In Figures	In Words
1	KSRRB M300-14. Excavation for roadwork in all types of soil by mechanical means including cutting and loading to tippers, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross sections, and transportation with a lead of 1.00 km and complete as per specifications MORTH Specificatio MORTH Specification No.301Loading and unloading with 10km lead	cum	5008.80	63.94	sixty three Rupees and ninety four paisa only
2	KSRRB 300-58. Compaction of original ground by mechanical means including filling in depression occuring during rolling including cost of all labour, HOM complete as per specifications.(I No-19.64,P No-147)	Sqm	16696.00	6.36	six Rupees and thirty six paisa only
3	Construction of granular sub-base Grading-V as Sub-base and drainage layer by providing coarse graded crushed stone aggregates of granite/ trap/basalt material, mixing in a mechanical mix plant at OMC, Carriage of mixed material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the 98 % proctor density, complete as per specifications	cum	2504.40	1994.92	one thousand nine hundred ninety four Rupees and ninety two paisa only
4	KSRRB M600-1.Providing and Constructing dry lean cement concrete mix CC 1:5:10 base with OPC 25mm and down size graded granite metal coarse aggregate at 0.86cum and 0.86cum and fine aggregate @0.58cum over a prepared sub-base,coarse and fine aggregate conforming to IS: 383-2016,aggregate cement ratio not to exceed 15:1.Aggregate gradation after blending to be as per Table 600-1,optimum moisture content to be determind during trial length construction,concrete strength not be determinde during trial length costruction, concrete strength not to be less than 10Mpa at 7 days,mixed in a batching plant,transported to site,laid with a paver,compacting with 8-10 tonnes vibratory roller, finishing and curing complete as per specications. Clause 601 of MORTH V Revision and IS 456 Table-5 , with OPC at 150 kg/cum and coarse aggregate 0.86 cum,fine aggregate 0.58 cum using concrete Batch mix Plant at 75 cum/hr capacity with fixed form paver	cum	656.78	4061.29	four thousand sixty one Rupees and twenty nine paisa only

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21	KSRRB M800-35. Supply and Installtion of Moulded Shank Raised Pavement Markers made of polycarbonate and ABS(Acrylonitrile Butadiene Styrene) moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face and shall support a load of 16000 kg tested in accordance to Specifications of Category A of MORTH Circular No RW/ NH/33023/10-97 - DO III Dt 11.06. 1997. The height, width and length shall not exceed 50 mm, 100 mm and 102 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base shall be 35 degree. The strength of detachment of the integrated cylindrical shanks, (of diameter not less than 19 mm and height not less than 30 mm) from the body is to be a minimum value of 500 Kg. Fixing will be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based adhesive as per manufacturer's recommendation and complete as directed by the engineer (Page No.187. Item No.24.41), SOR 2018-19		No	1193.85	357.22	three hundred fifty seven Rupees and twenty two paisa only	

"No OF CORRECTION NIL"
"DTS APPROVED"

Executive Engineer
Yelahanka Sub Divisio
BBMP

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ಬೃಹತ್ ಬೆಂಗಳೂರು ಮಹಾನಗರ ಪಾಲಿಕೆ

AARTN ASSOCIATES ★ BANGALORE ★

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PHOTOS

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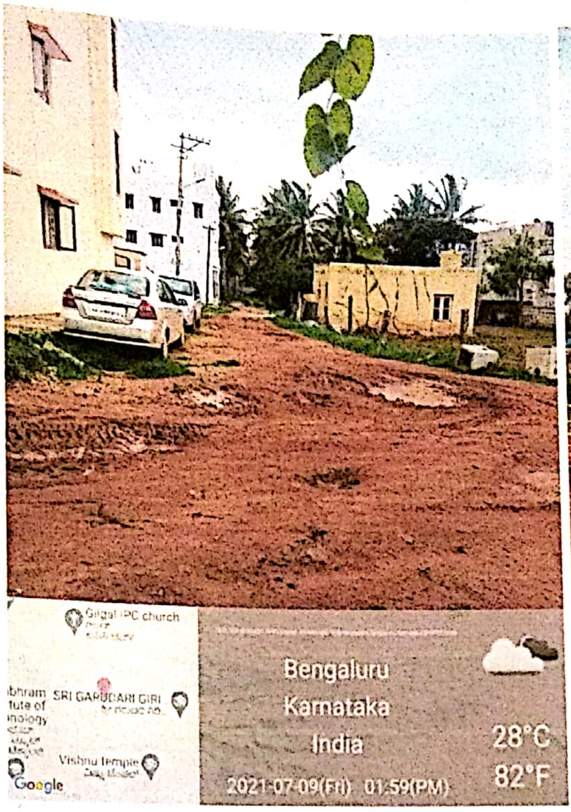
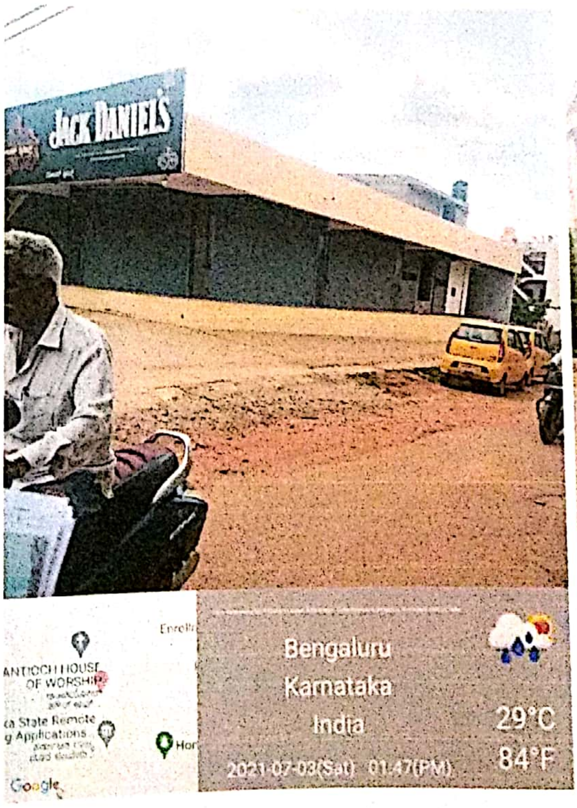
Kaveri Layout:-





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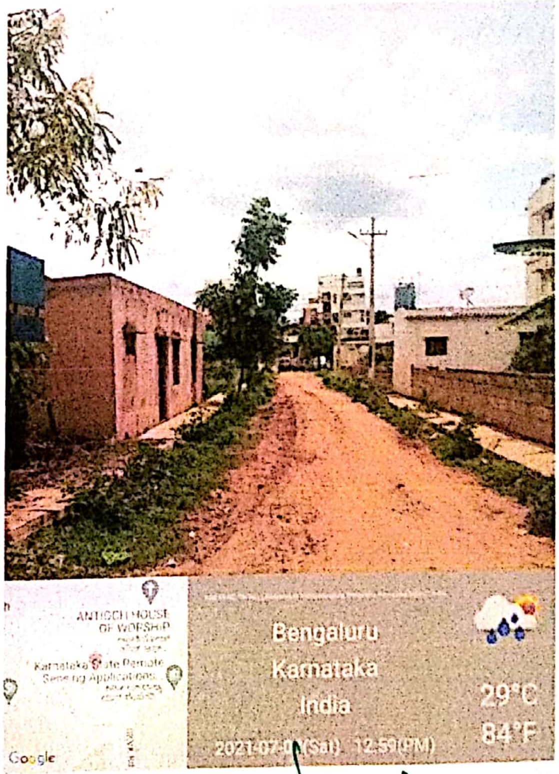

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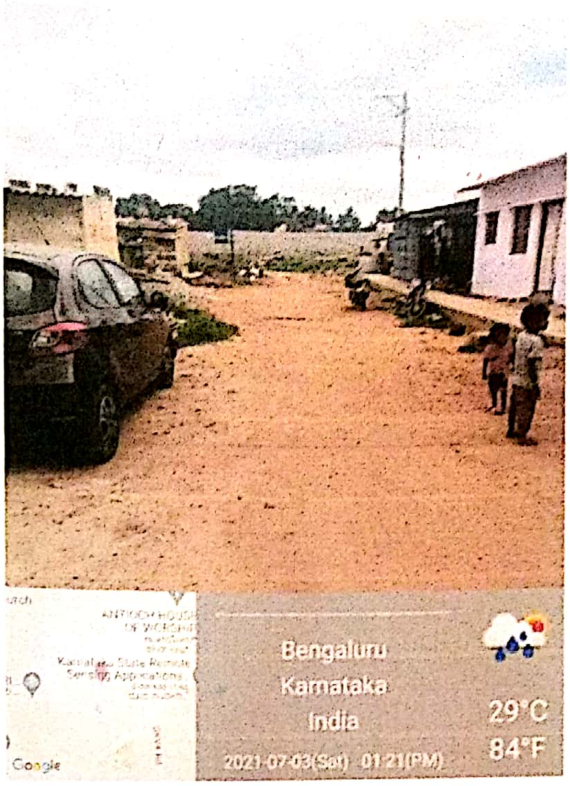

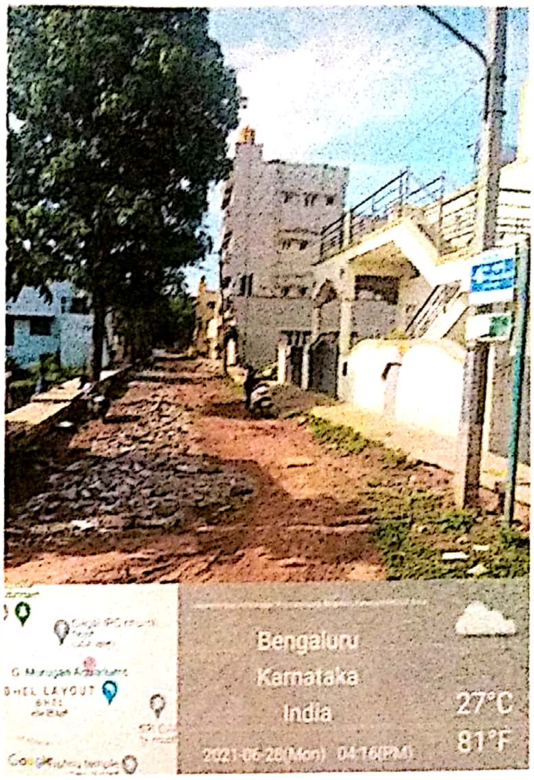

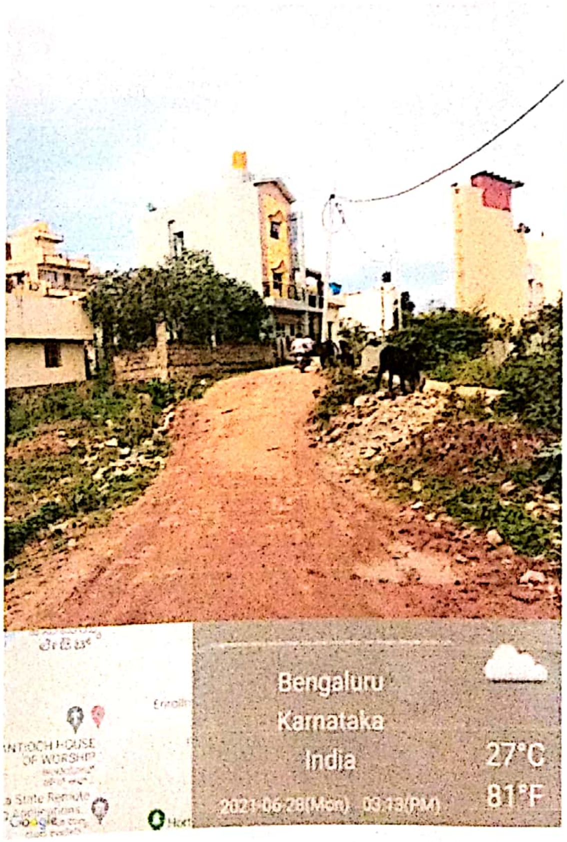

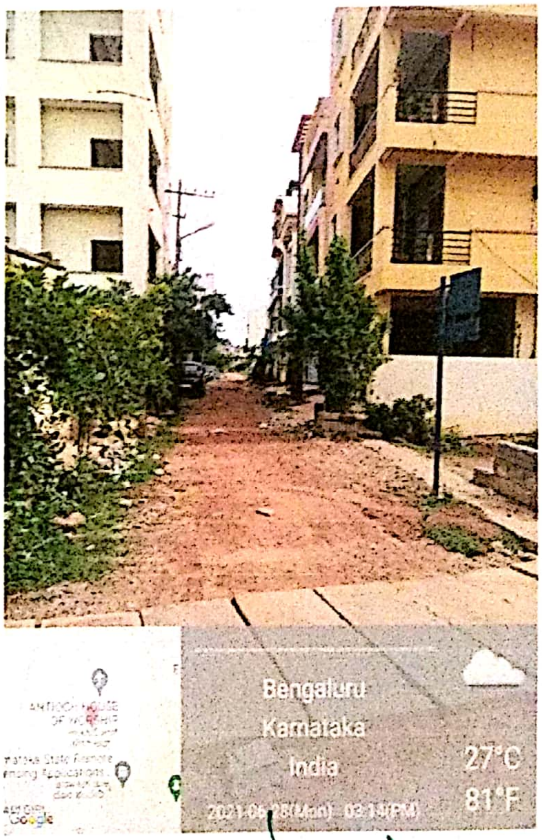

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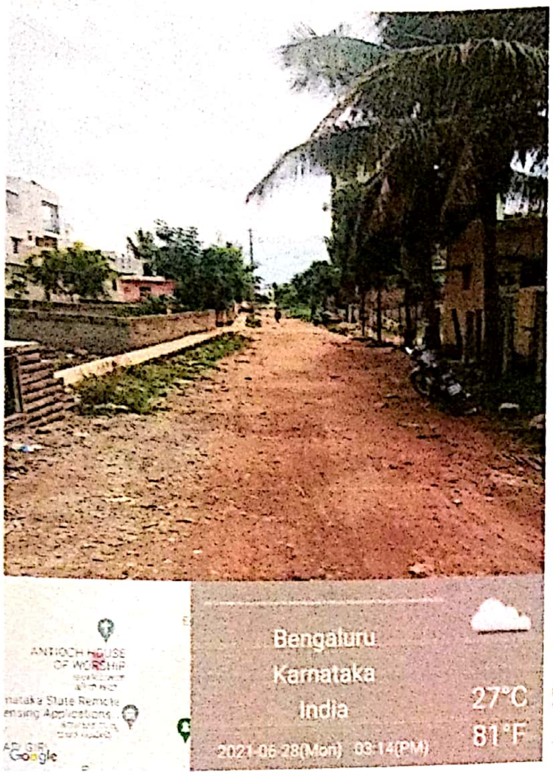

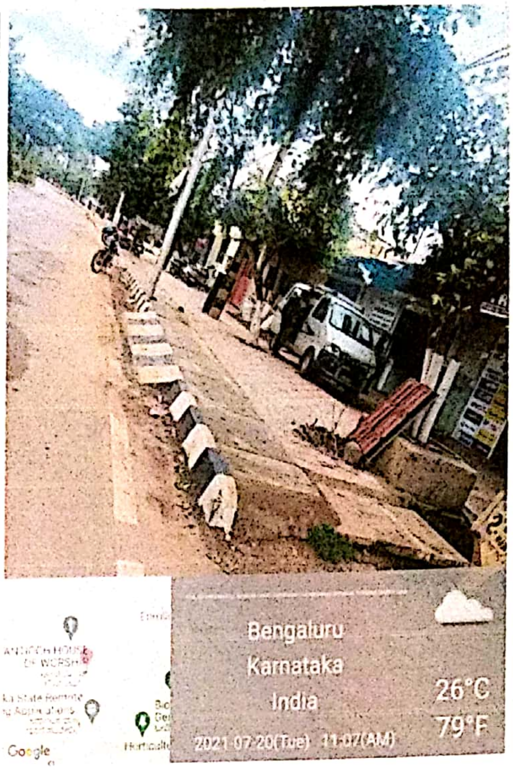

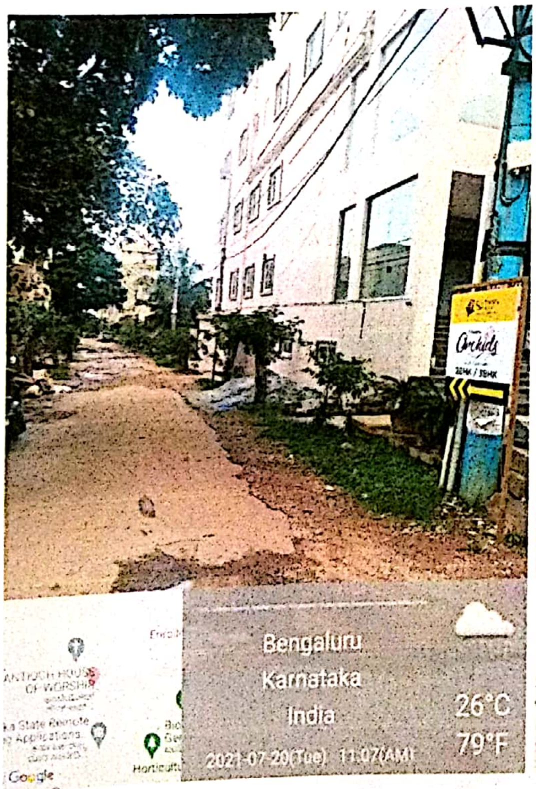

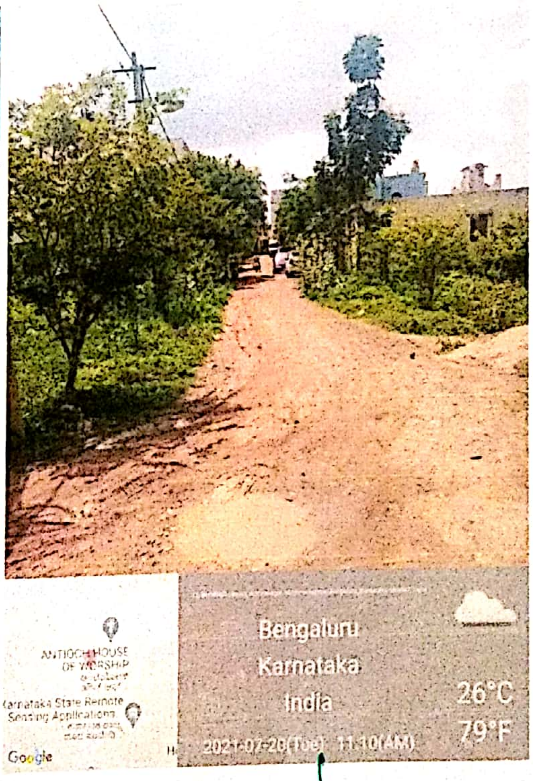

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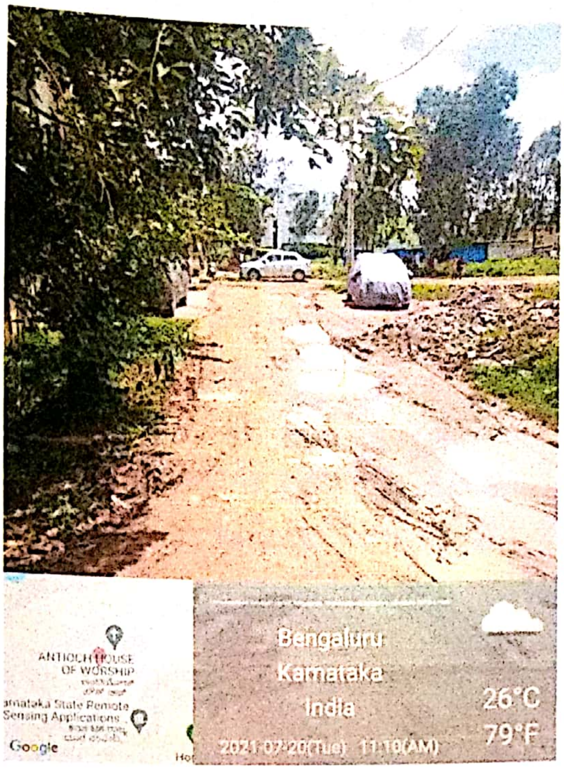

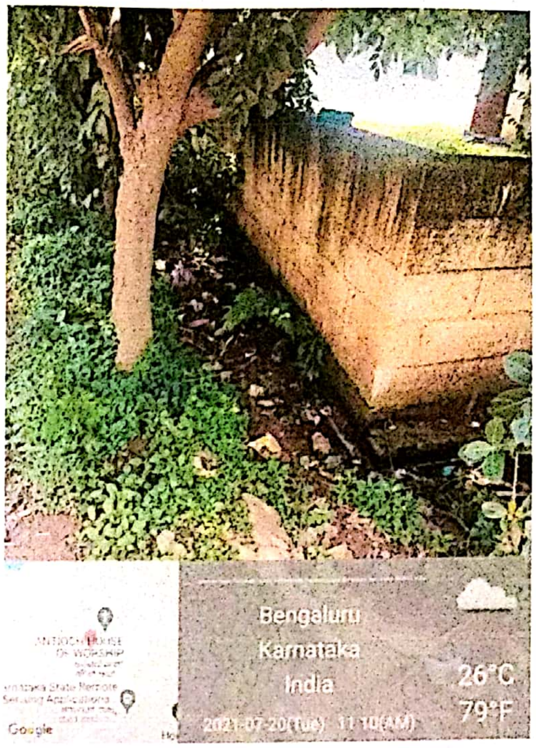

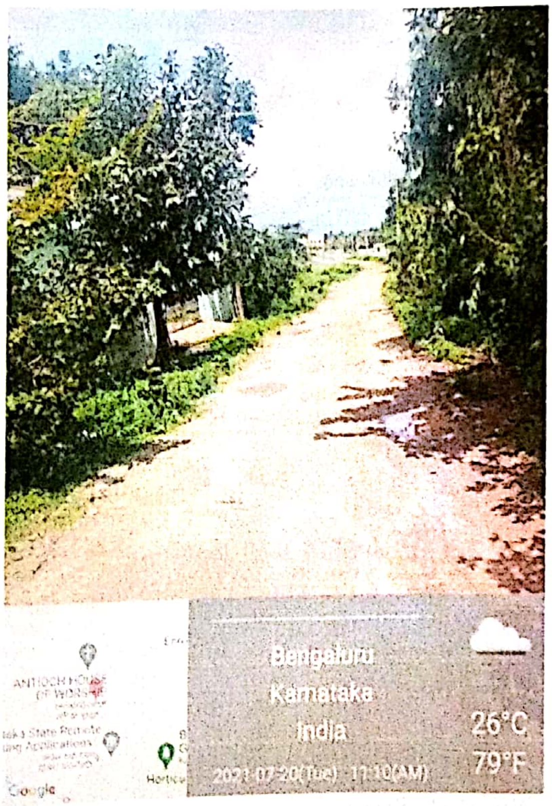

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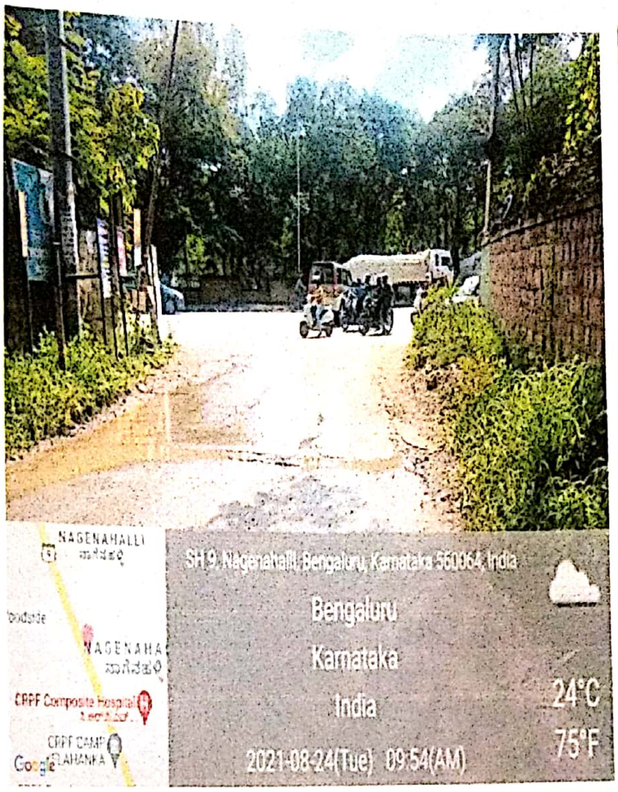
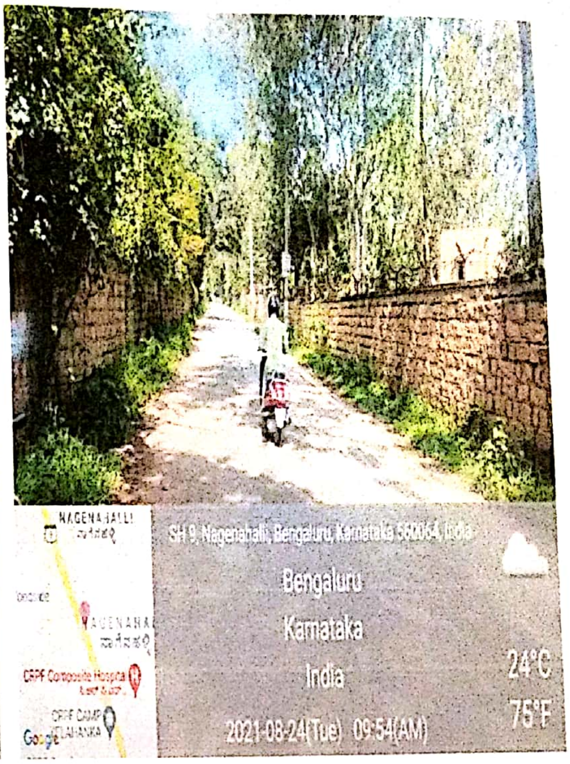
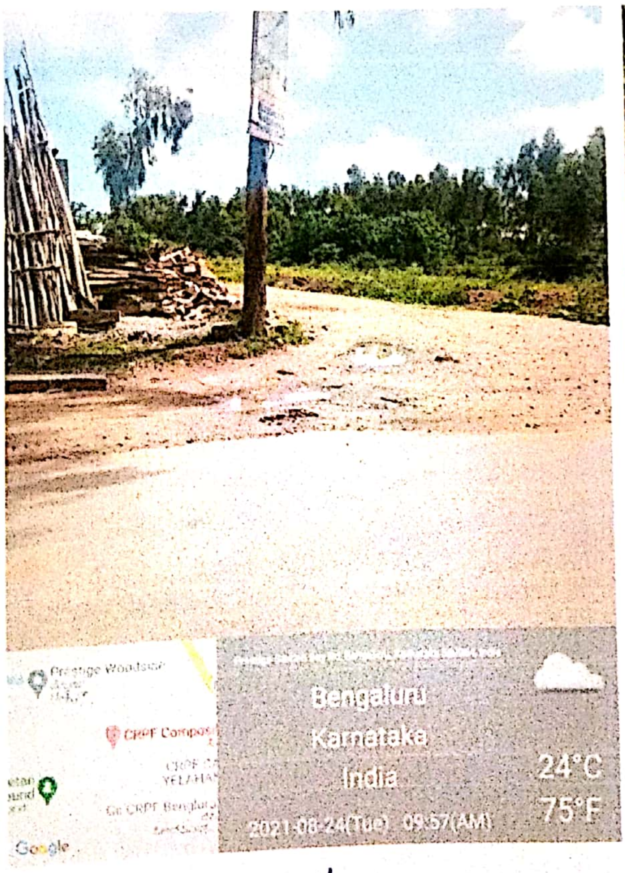
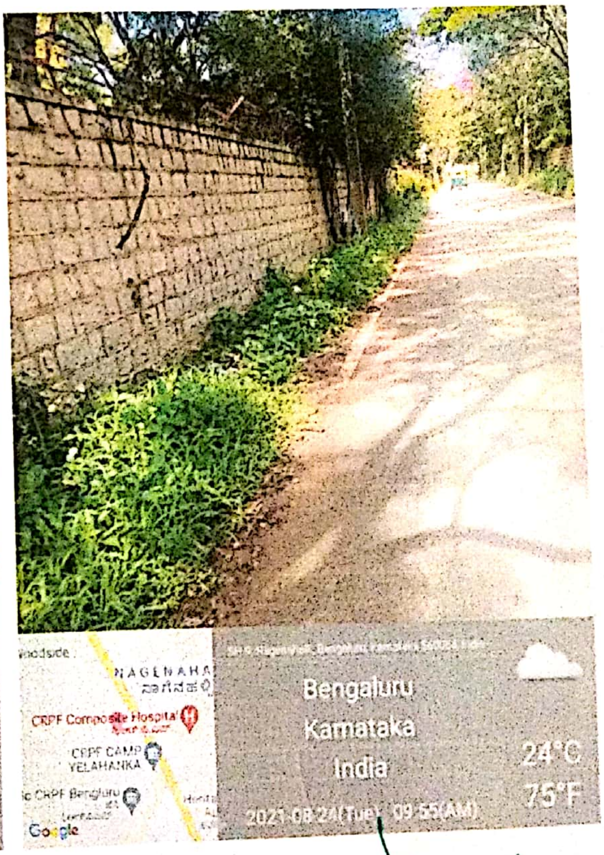
Nagarjuna College:-









ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು
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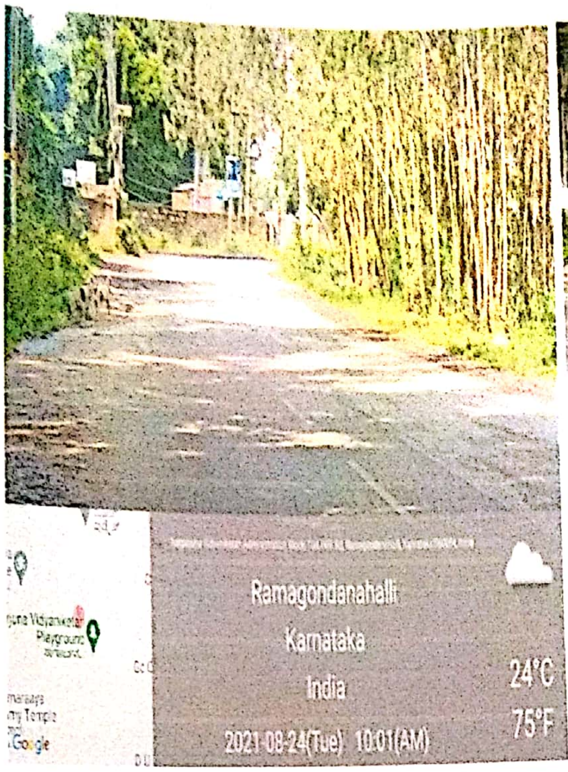

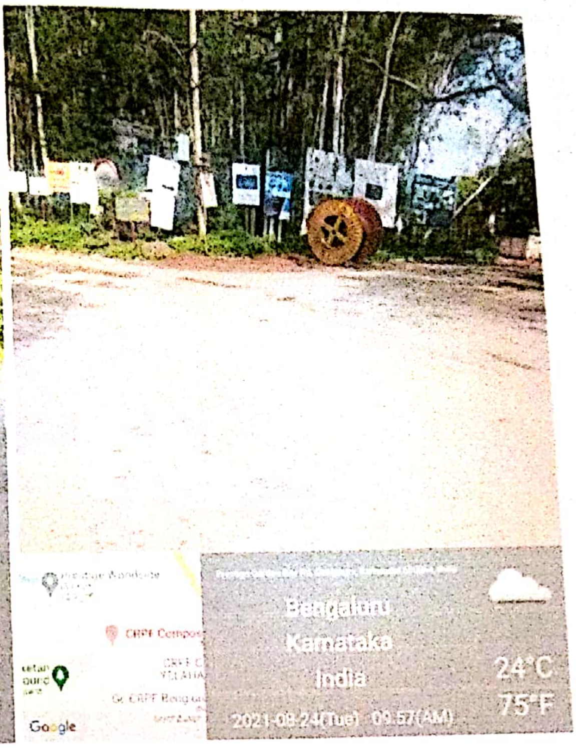

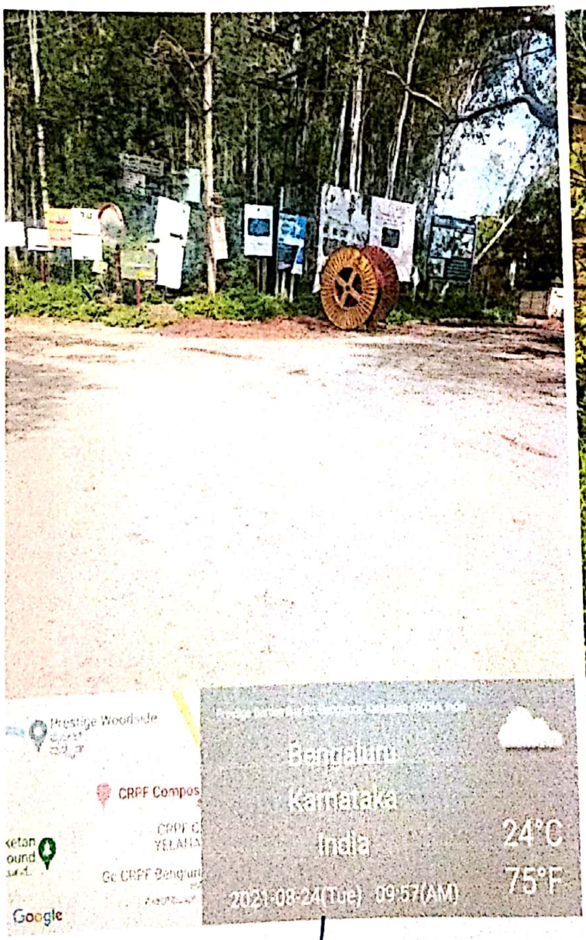

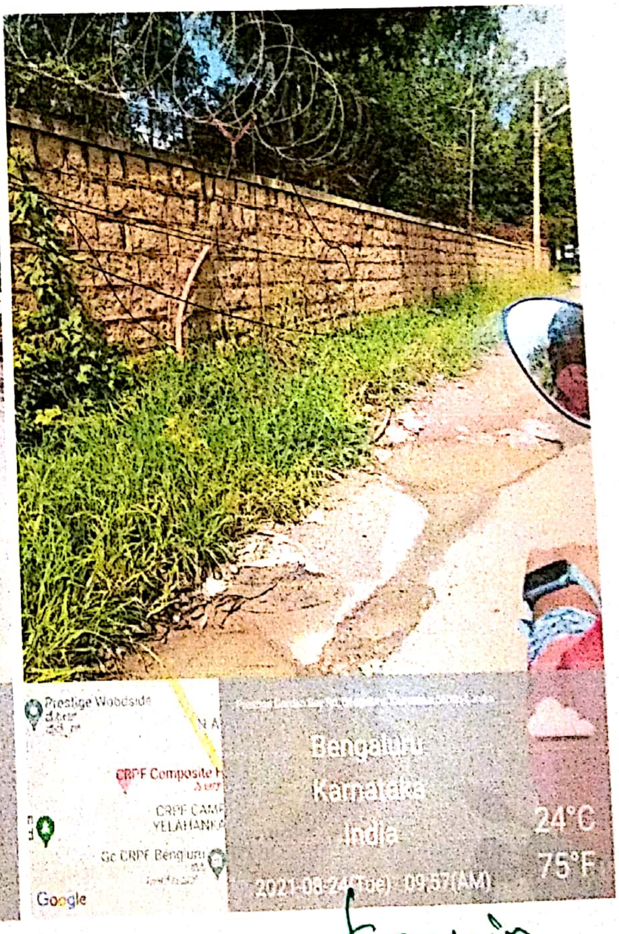

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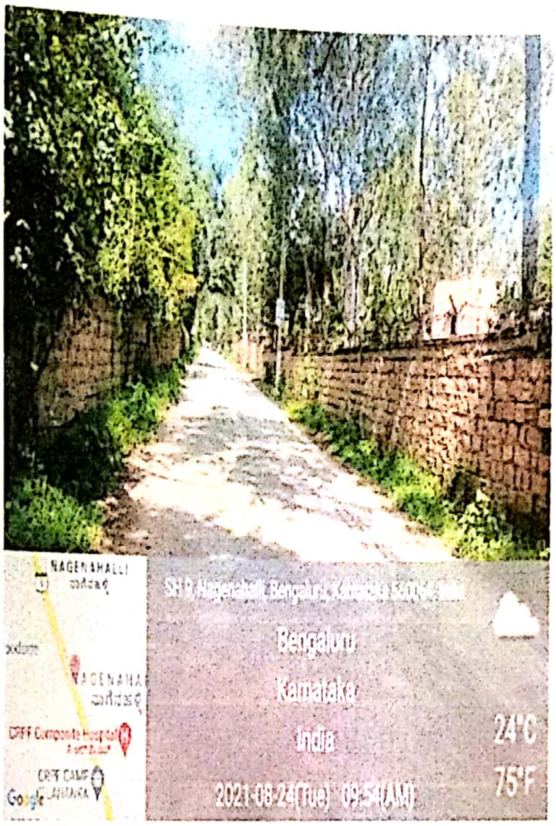

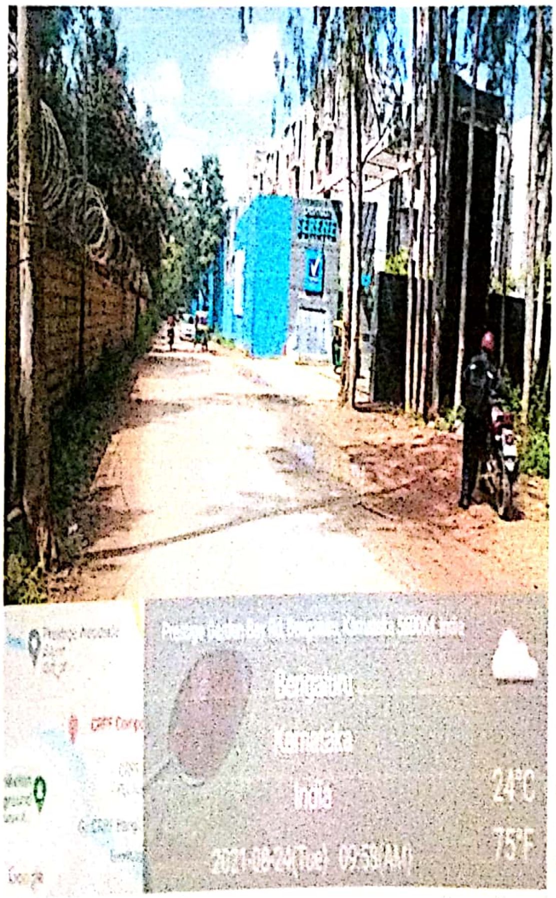

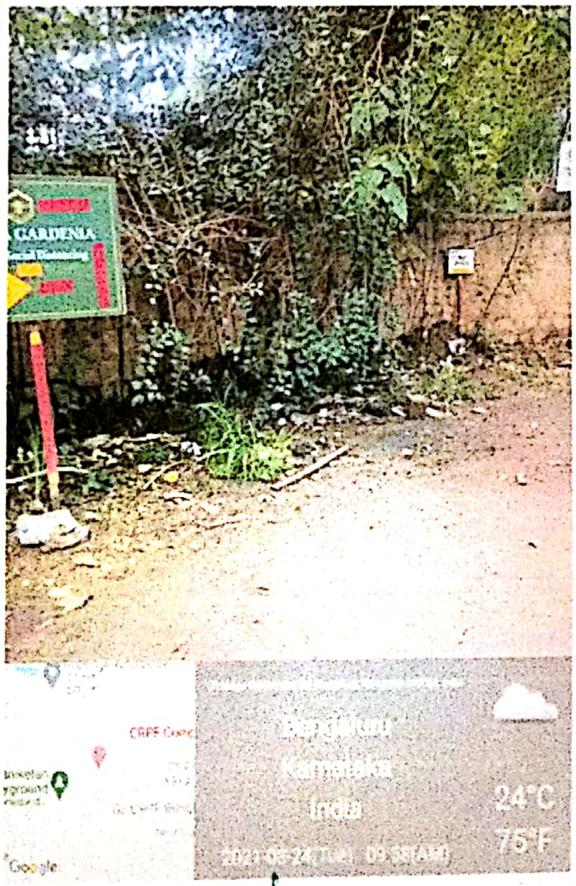

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KEY MAP

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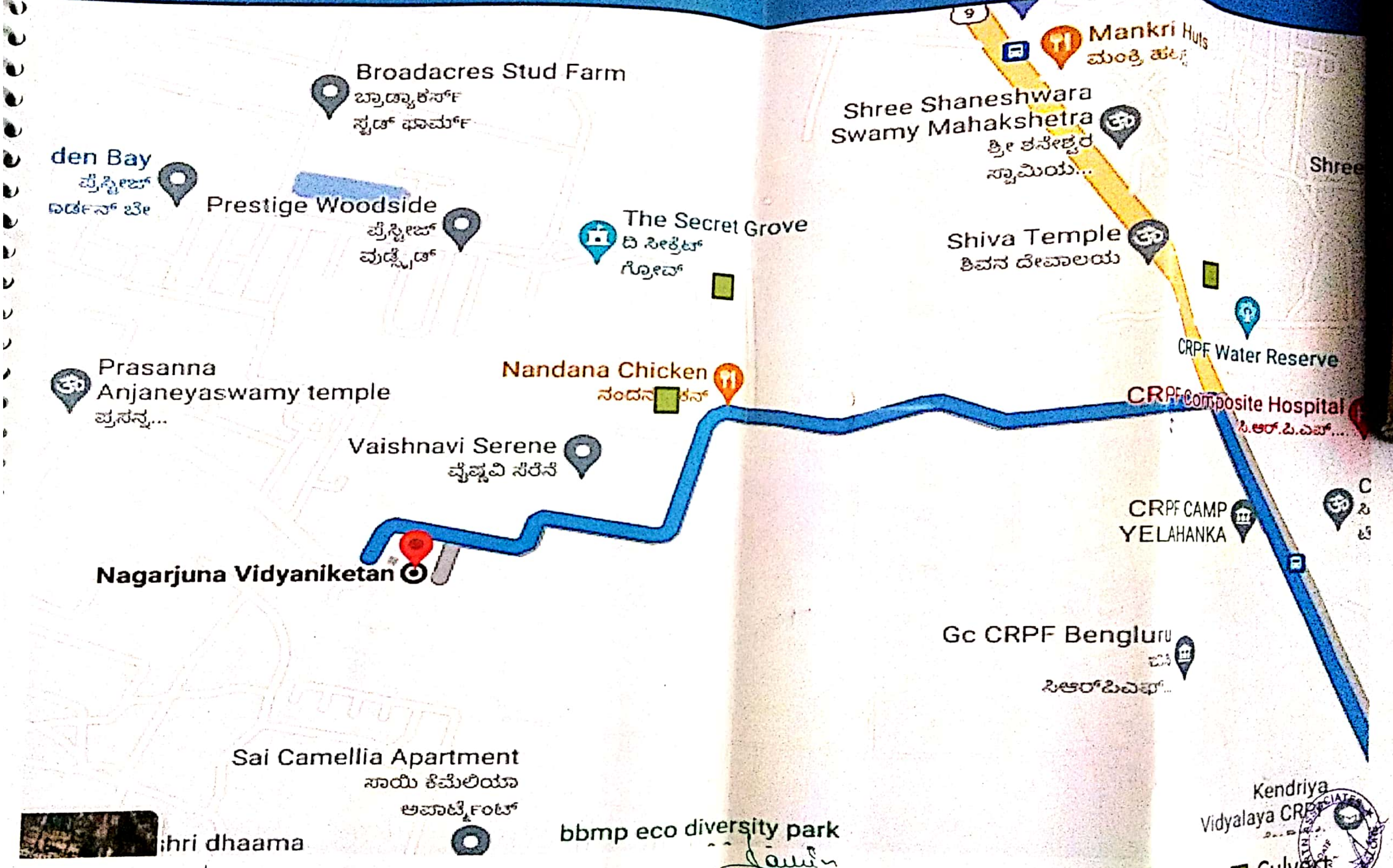
Restoration and Improvements from Doddaballapura Main Road to Nagarjuna college, and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.



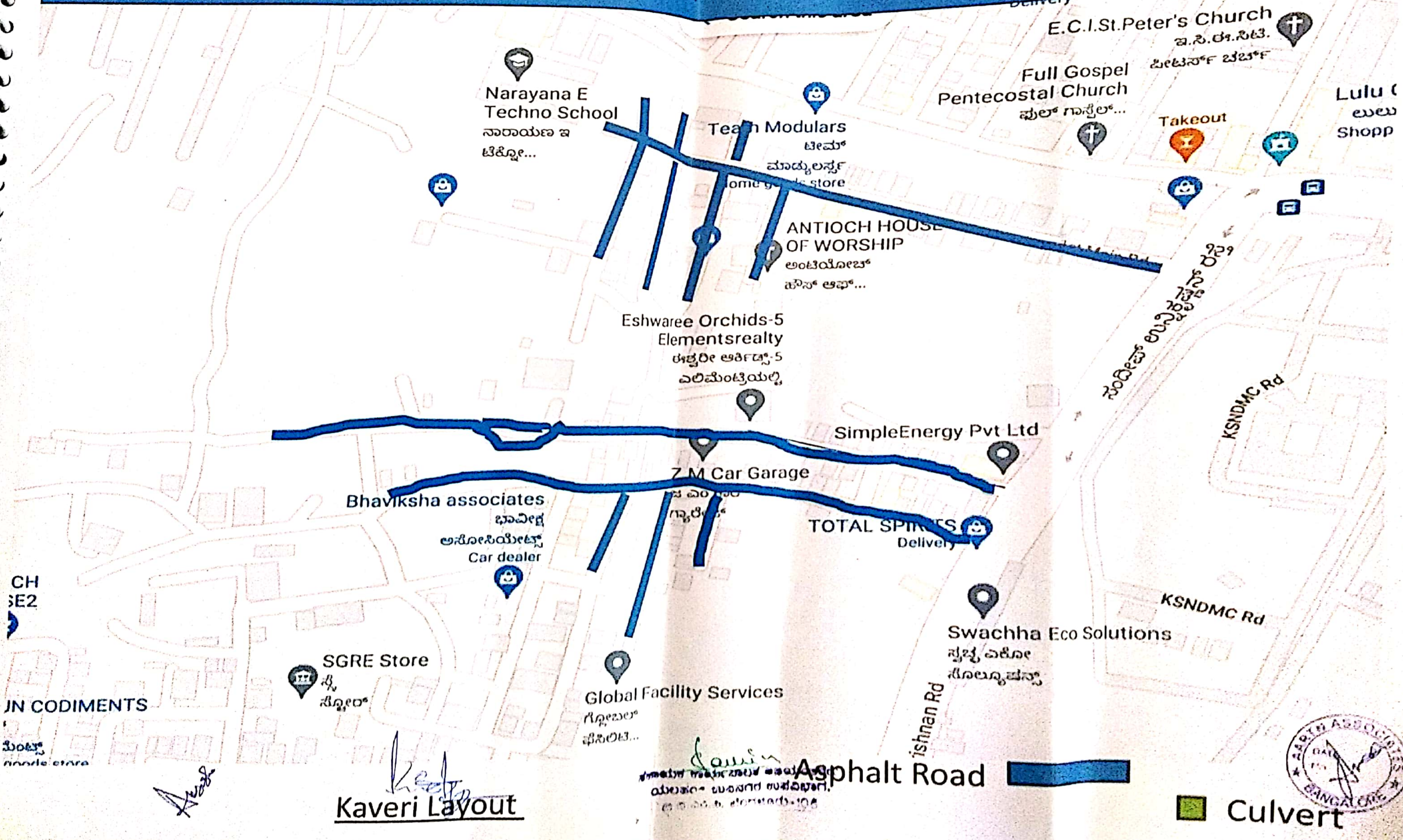
Nagarjuna Collage

Asphalt Road

Culvert

ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು,
ಯಲಹಂಕ ಉಪನಗರ ಉಪವಿಭಾಗ,
ಬಿ.ಬಿ.ಎಂ.ಪಿ. ಬೆಂಗಳೂರು-106

Restoration and Improvements of Kaveri layout, and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.



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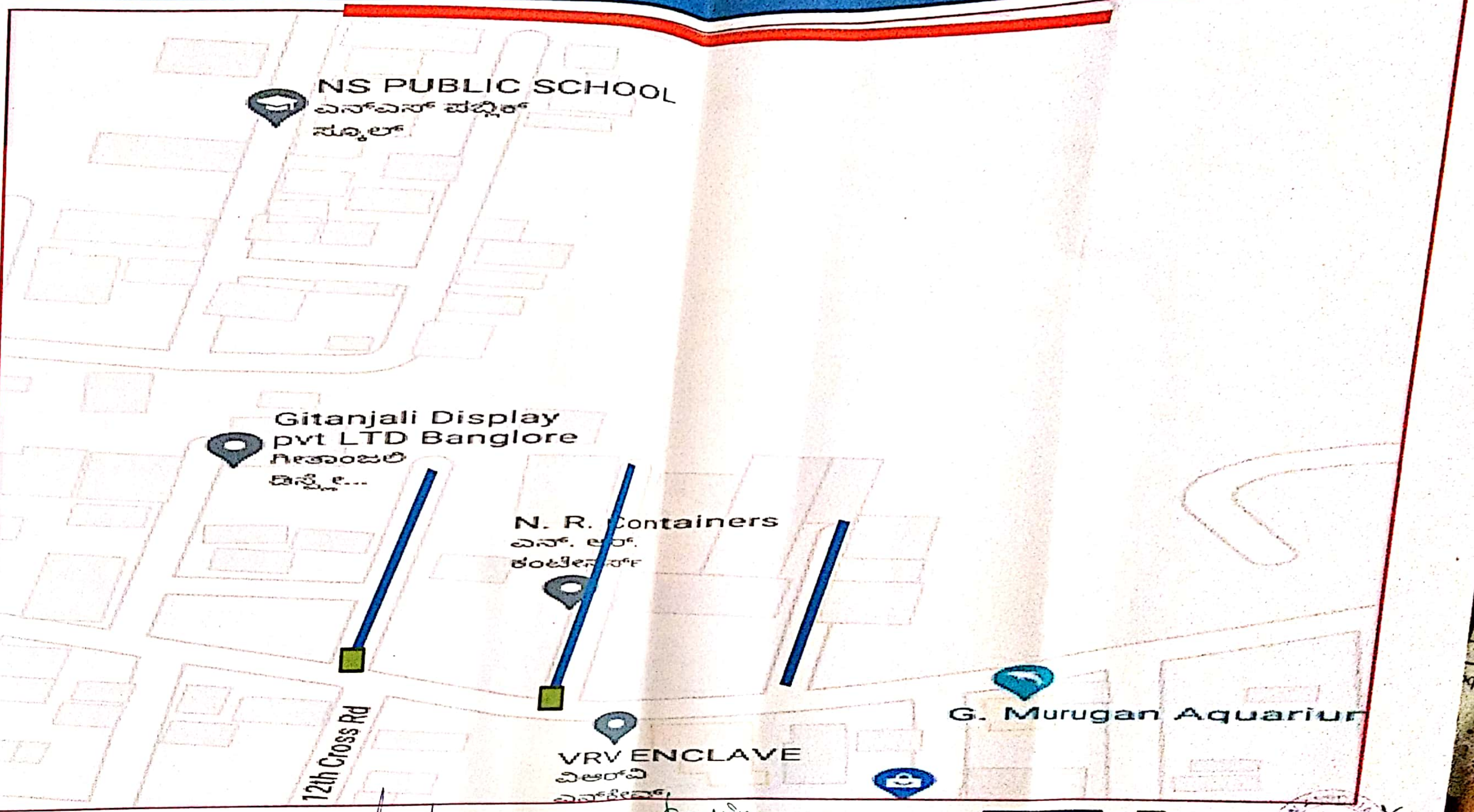
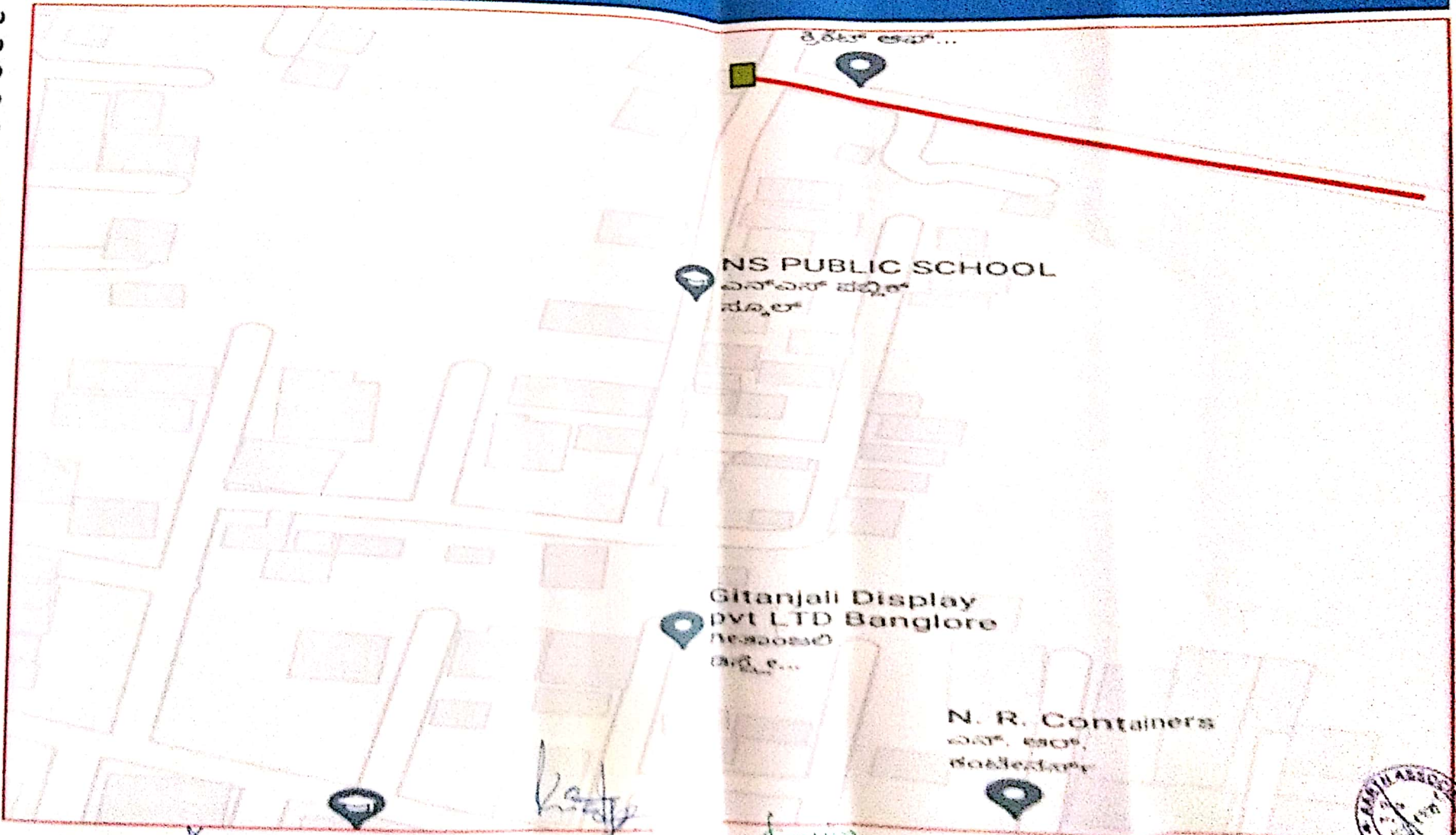
Restoration and Improvements of Chowadappa layout Maruthinagara, Hariraja layout and surrounding areas in ward no-03 of Yelahanka Satellite town sub division.



Hariraj Layout

Asphalt Road
Culvert
CC Road
Drain

Restoration and Improvements of Maruthinagara in ward no-03 of Yelahanka Satellite town sub division.



Drain

Culvert

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DRAWINGS

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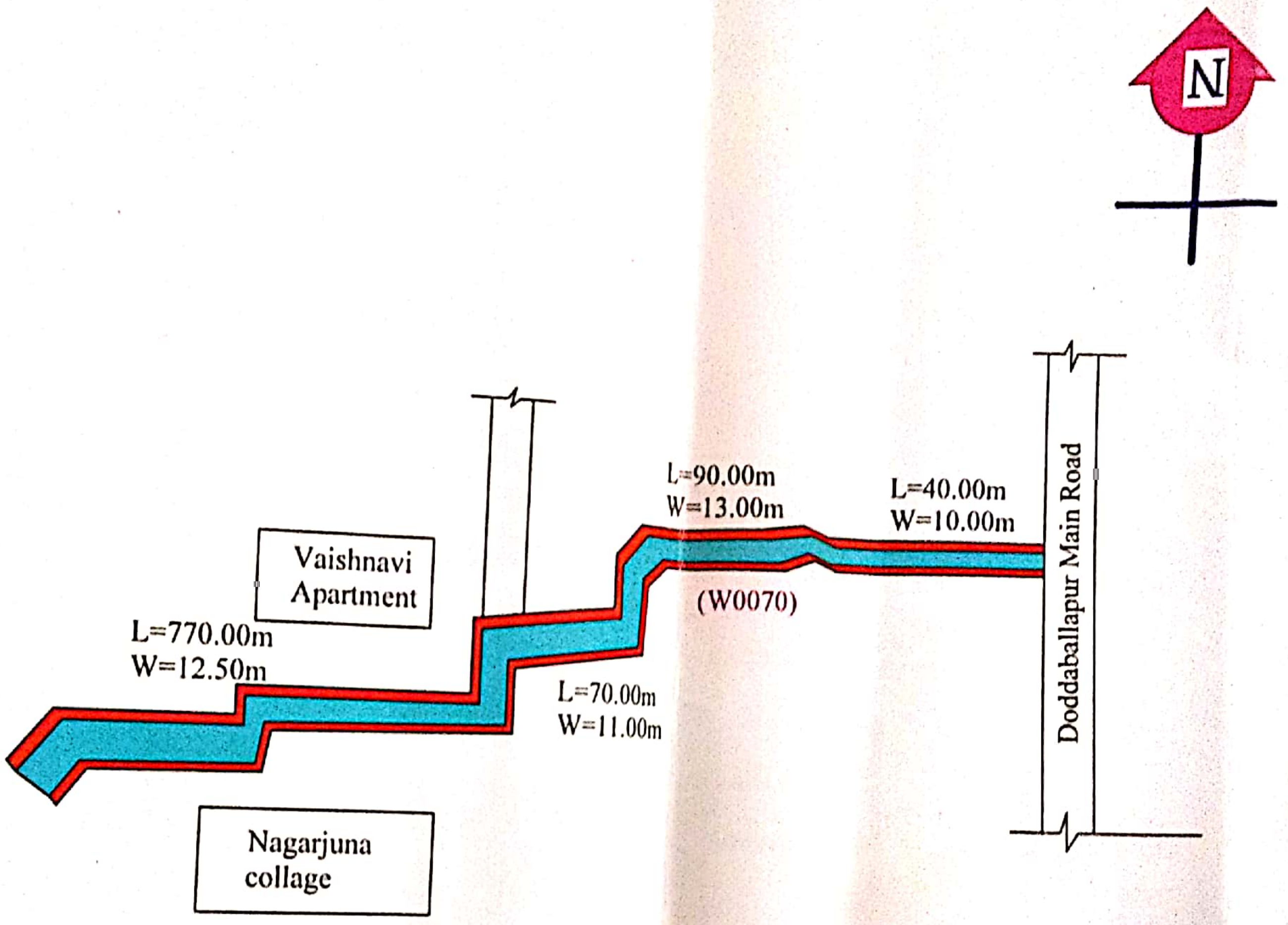

Nagarjuna collage

Aartn Associates

Assistant Engineer

Assistant Executive Engineer
Division 1,
Bangalore-64.

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AARTN ASSOCIATES

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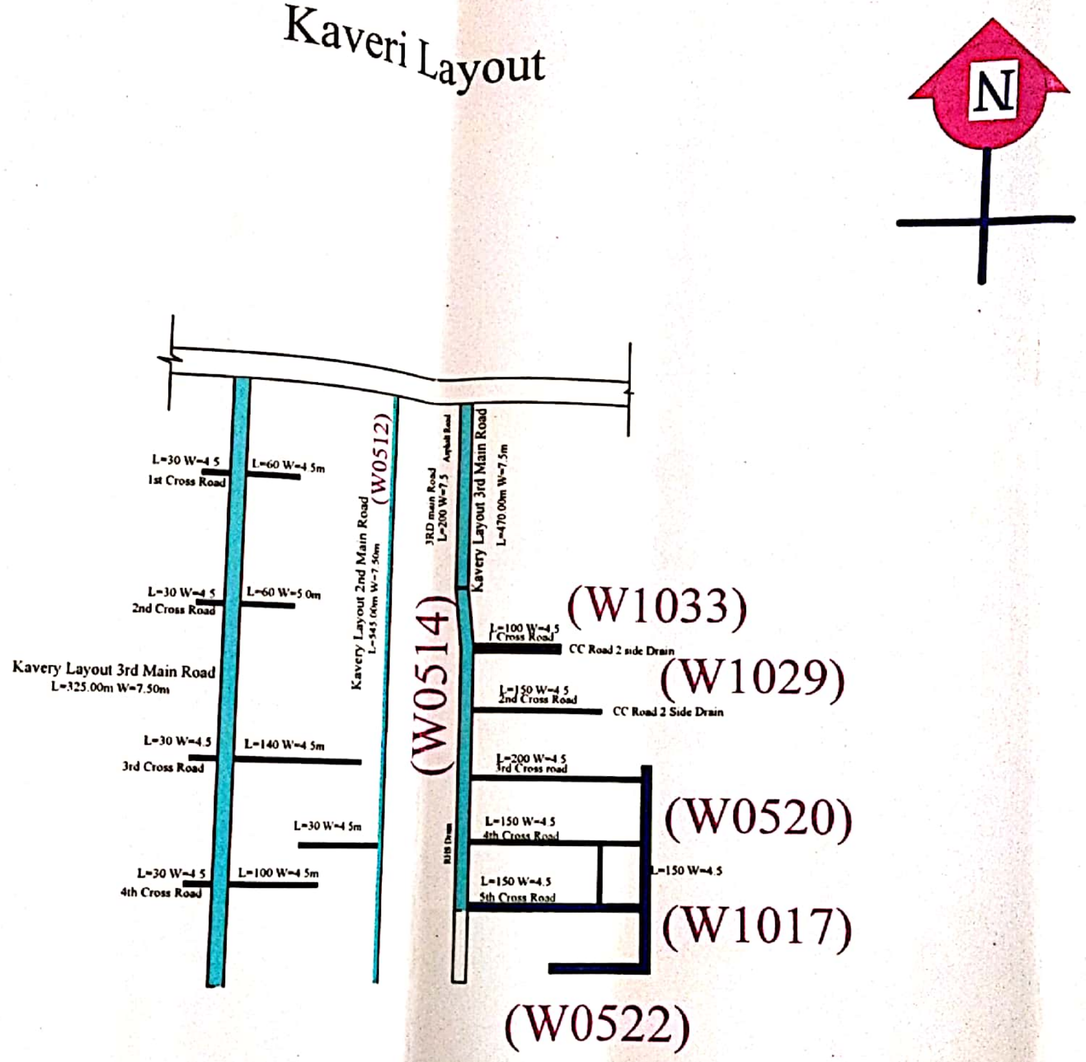
Kaveri Layout



Assistant Engineer

Assistant Executive Engineer
Yelahanka Sub Division
Bangalore

Aartn Associates

CLIENT:

BRUHAT BANGALORE MAHANAGARA PALIKE

CONSULTANT:-
AARTN ASSOCIATES

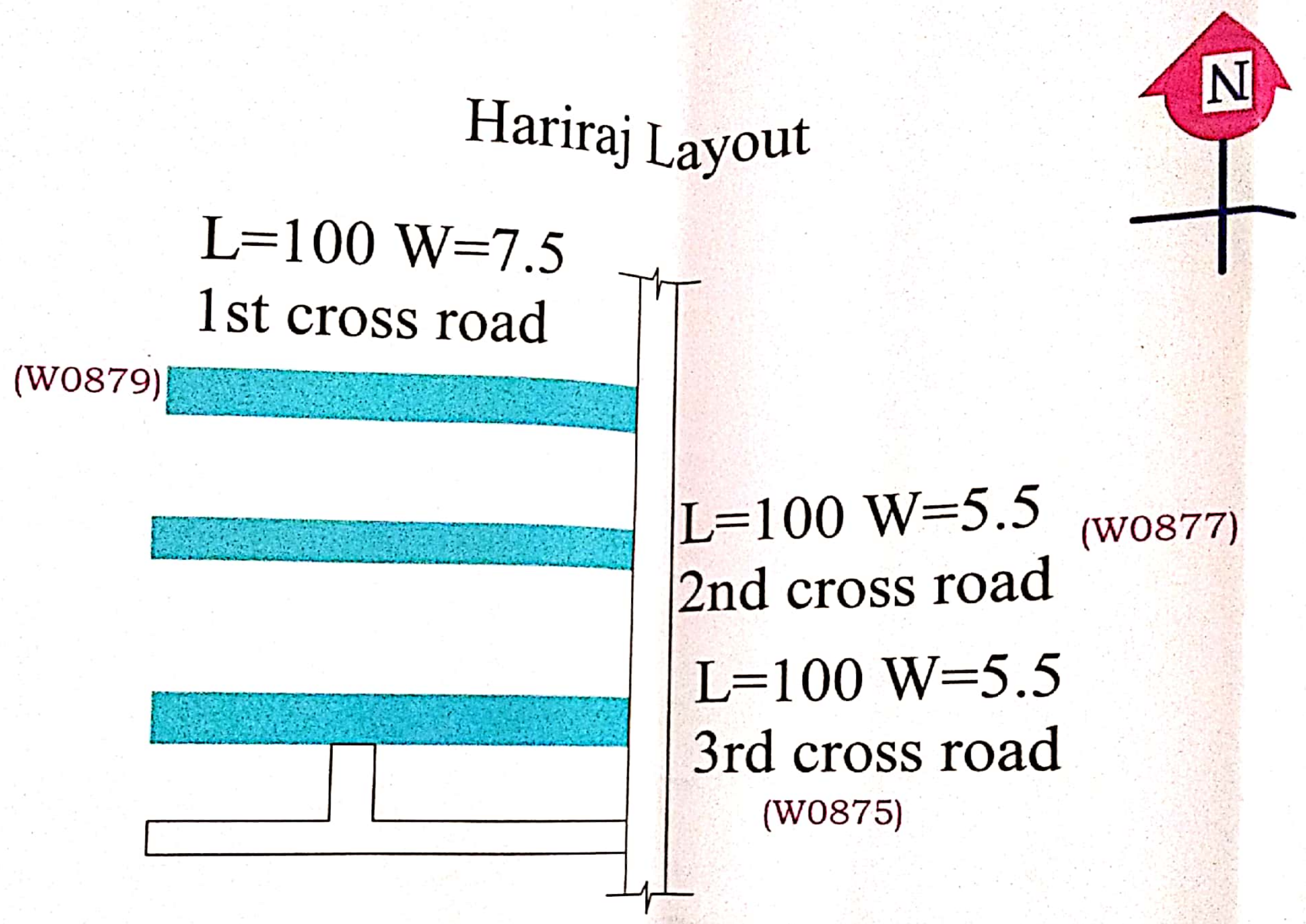
PROJECT:-

Prepared by		TITLE :	Restoration and Improvements of Kavery layout and surrounding areas in ward ... of Yelahanka ...
Designed by			
Checked by		GO Sl No. :	
Reviewed by			
Date		SCALE :	NTS

Revisions

Rev	Date	Description
R0		

AARTN ASSOCIATES
DATE
No.
BANGALORE



Aartn Associates

Assistant Engineer

Assistant Executive Engineer
Yelahanka Division
Bangalore

CLIENT:

BRUHAT BANGALORE MAHANAGARA PALIKE

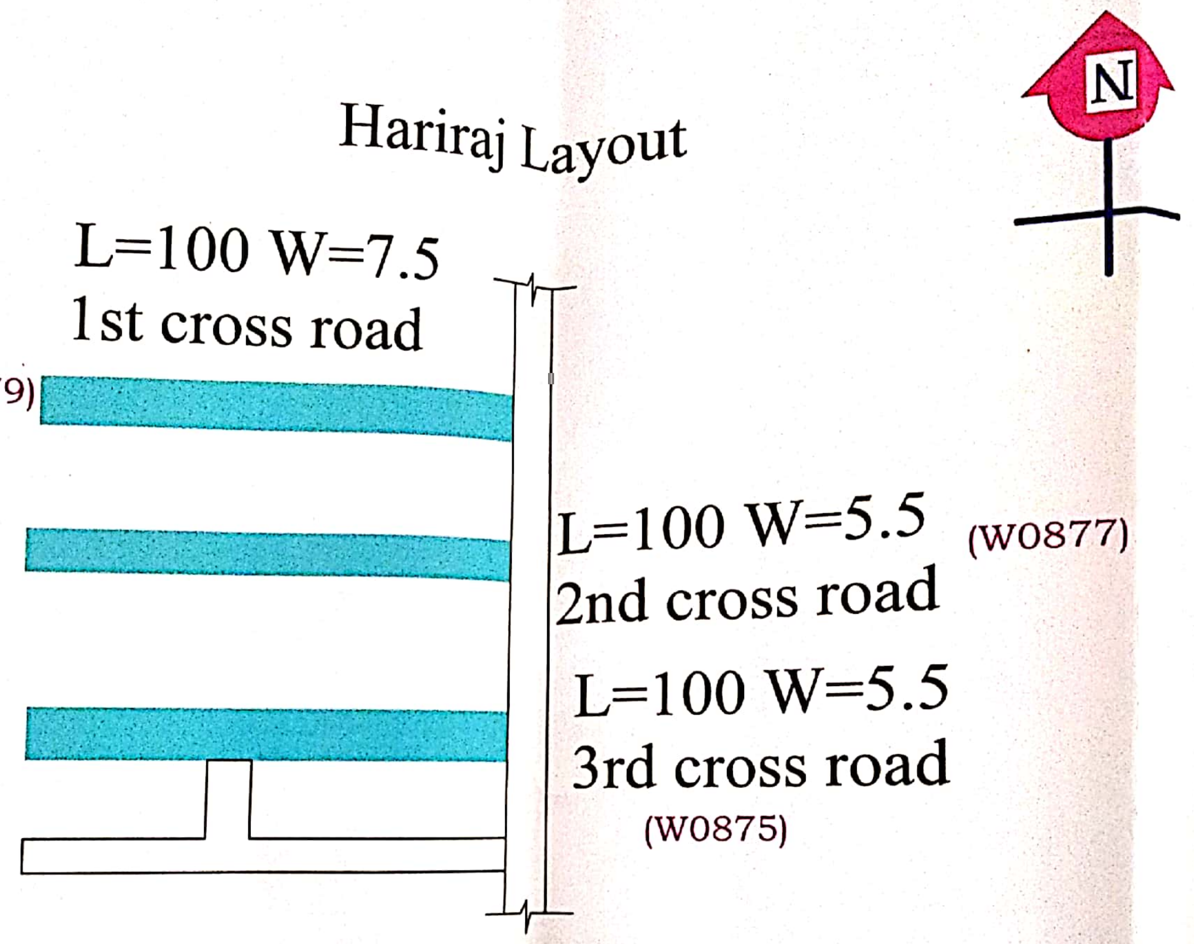
CONSULTANT -

AARTN ASSOCIATES

PROJECT -

SCALE NTS

Hariraj Layout



Aartn Associates

Assistant Engineer

Assistant Executive Engineer
Yelahanka Sub Division
Bangalore-64

CLIENT: BRUHAT BANGALORE MAHANAGARA PALIKE	CONSULTANT:- AARTN ASSOCIATES	PROJECT:-	Prepared by / Designed by / Checked by / Reviewed by / Date	TITLE: / GO Sl No. / SCALE: NTS

AARTN ASSOCIATES
DATE
BANGALORE

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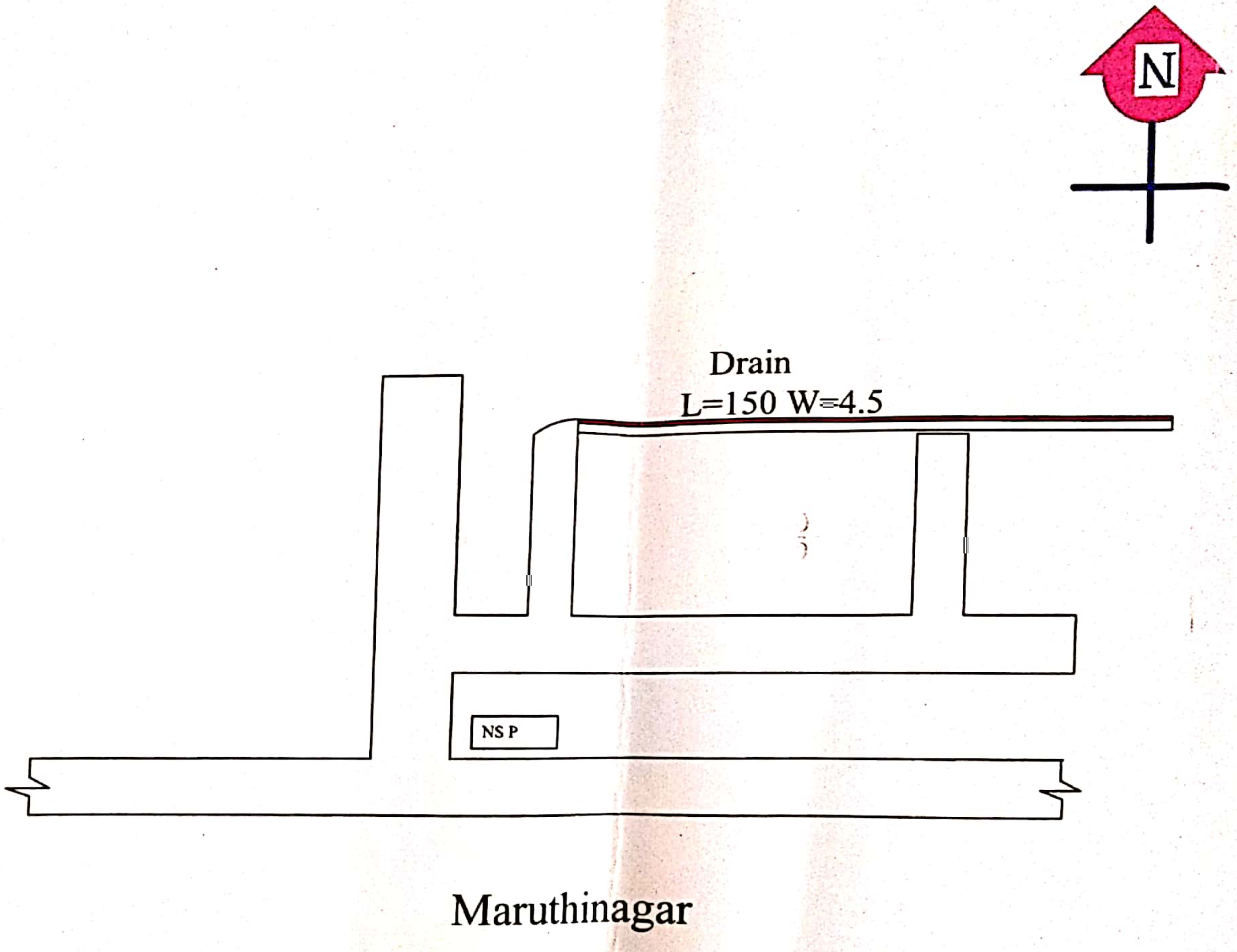

Aartn Associates

Assistant Engineer

Assistant Executive Engineer
Yelahanka Sub Division
Bangalore-64

CLIENT:	CONSULTANT:-	PROJECT:-		TITLE:
BRUHAT BANGALORE MAHANAGARA PALIKE	AARTN ASSOCIATES			Maruthinagar
				SCALE NTS